



Environment
Canada

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Canada

Résumé
en français

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Canada and the Human Environment

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of Canada to the United Nations
Conference on the Human Environment
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Le Canada et
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Minister, Environment Canada

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Foreword

Nature's laws are universal. They are far-reaching. They are all-embracing. Man breaks them at his peril. He breaks them and succeeding generations are the poorer for his lack of foresight, his lack of sensitivity, his lack of discipline on the environmental front.

This truism applies not only locally but nationally and internationally as well. It applies in big countries as well as small countries. It applies in the core areas of big cities and in the wilderness. It applies to industry and to individuals wherever they may be.

Nature has been kind to mankind. But nature's response has limits. Its recuperative powers are finite. It cannot stand the massive onslaught of mankind in his millions. It cannot withstand his thoughtless depredations, so man must learn to respect the laws of nature and live within their bounds as the earth's other creatures have to do.

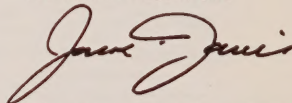
I am not, at the same time, one of those who decry economic growth. For a time, at least, man's numbers will continue to mount, especially in lightly populated countries like Canada. More meaningful jobs are needed for more hands. But it is the character of these jobs, not their number, which is really at issue. They must go with the grain of nature, not against it. Instead of debasing the quality of air, water and soil, instead of destroying animal and plant life, they must maintain the quality of the environment and the extent and variety of life.

To state it more simply, I believe we can have planned economic growth and environmental quality too. We must achieve these twin objectives. We can do this in Canada by harvesting our forests on a sustained yield basis, by producing fertilizers from barren rock, by using warm thermal plant discharges to grow more fish, and so on.

What bothers me most is the thought that man, as his numbers and affluence increase, seems bent on creating a dull and uninteresting environment for himself. Mass production, mass consumption, mass disposal, massive refuse heaps – all these are characteristic of an age which has lost sight of the balance of nature, of the revitalizing force which still exists in our great outdoors and which, itself, is threatened by our increasingly pedestrian way of life.

Obviously, we need new attitudes and new laws to protect our fragile environment from our depredations. These laws, like nature's laws, must be universal. They must be more than local, more than regional, more than national. They must be global. They must apply to the super power as well as its tiny neighbour. They must apply in every latitude and in every clime.

Nature's laws are universal. Man-made laws can and must be universal as well. I recommend this thought, not only to Canadians but also to the representatives of all the other nations attending the U.N. Conference on the Human Environment.



The Honourable Jack Davis
Minister of the Environment for Canada

Editor's Note

This is a report on the status of the environment in Canada in 1972. It is not a statement of Canadian policy for the future. It has been prepared for the U.N. Conference in Stockholm, and for Canadians, by officials of several departments of the Government of Canada. It attempts to reflect submissions and comments from provincial governments and a selected group of non-governmental organizations representative of industry and the Canadian public.

In Canada, as in other nations, there is a diversity of opinion on the causes, effects and proper treatment of environmental degradation. While the contributions of other governments and non-governmental organizations have been most helpful, only Environment Canada, a department of the Government of Canada, is responsible for the text of this report.

A report of this length cannot be an exhaustive treatment of a complex subject. For those who would delve deeper, the following documents are submitted as an integral part of Canada's National Report to the 1972 United Nations Conference on the Human Environment.

Canadian Council of Resource Ministers

Report No. 1

Intergovernmental Steering Committee on Pollution, May 1970

Report No. 2

Intergovernmental Committee on Pollution, October 1970

J. W. MacNeill

"Environmental Management" — A constitutional study prepared for the Government of Canada

Science Council of Canada

Report No. 3

"A Major Program of Water Resources Research in Canada"

Report No. 7

"Earth Sciences Serving the Nation"

Report No. 8

"Seeing the Forest and the Trees"

Report No. 9

"This Land Is Their Land"

Report No. 10

"Canada, Science and the Oceans"

Report No. 12

"Two Blades of Grass: The Challenge Facing Agriculture"

Report No. 14

"Cities for Tomorrow: Some Applications of Science and Technology to Urban Development"

Report No. 16

"It's not too late — yet"

The Science Council was set up by the Government of Canada but is given total freedom to examine, criticize, comment, recommend and publish as it sees fit. Because of the Council's independent nature, its reports do not necessarily reflect the policy of the government. However, its opinions are respected and studied.

Environment Canada

"Environment Canada — Its Organization and Objectives"

Avant-propos

Les lois de la nature sont universelles. L'homme ne peut les transgresser impunément et ce sont les générations à venir qui porteront le poids de son entêtement, de son insensibilité et de son indiscipline vis-à-vis de l'environnement. Cette évidence s'applique non seulement au niveau local mais tout aussi bien au plan national et international! Elle se vérifie autant dans le centre-ville des grandes métropoles qu'au coeur de nos vastes parcs nationaux. Elle touche autant l'industrie que l'individu peu importe où il se trouve.

La nature a été généreuse pour l'homme, tout particulièrement pour le Canadien; ses pouvoirs de récupération n'en sont pas moins restreints. Elle ne peut résister aux assauts massifs et répétés de millions d'hommes ni à leurs pillages irréflechis. L'homme devra donc apprendre à en respecter les lois et à vivre selon ses prescriptions comme toutes les autres créatures de la terre ont appris à le faire.

Je ne suis cependant pas de ceux qui s'opposent à l'expansion économique. La population du globe continuera de s'accroître, au moins pendant un certain temps, tout particulièrement dans les pays sous-peuplés comme le Canada. Il faudra occuper un plus grand nombre de bras à des tâches valables et c'est surtout le caractère de ces emplois plutôt que leur nombre qui est le noeud du problème. Ces emplois devront respecter l'harmonie de la nature et non y faire obstacle. Au lieu de menacer la faune et la végétation, ils devront en permettre l'épanouissement et la diversification.

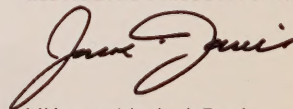
Je crois qu'il est possible d'allier expansion économique et qualité de l'environnement. Il est essentiel de réaliser ce double objectif. Et c'est possible au Canada, si nous faisons l'exploitation de nos forêts en prenant soin d'en maintenir le rendement, si

nous utilisons les eaux chaudes de nos installations thermales pour accroître nos bancs des poissons, et si nous adoptons une foule d'autres moyens aussi ingénieux les uns que les autres.

Ce qui me préoccupe le plus, c'est la pensée que l'homme moderne semble déterminé, à mesure que la population devient plus grande et plus affluente, à se créer un environnement morne et terne. La production de masse, la consommation de masse, l'évacuation de masse qui se traduit par des montagnes de déchets, sont autant de caractéristiques d'une époque où l'on a oublié l'équilibre de la nature et le pouvoir régénérateur de nos grands espaces vierges, équilibre qui est lui-même menacé par un mode de vie qui devient chaque jour plus routinier.

Nous avons manifestement besoin de nouvelles lois pour protéger un environnement aussi fragile contre l'étourderie et l'insatiabilité de l'homme. Ces lois, pour être au diapason de la nature, doivent être universelles. Elles doivent dépasser les cadres locaux, régionaux ou nationaux et avoir une envergure globale; elles doivent s'appliquer autant au pays très puissant qu'à son voisin plus modeste; elles doivent s'appliquer sous toutes les latitudes et dans tous les climats.

Les lois de la nature sont universelles! Et les lois humaines non seulement peuvent, mais doivent l'être! Voilà un élément de réflexion que je propose non seulement aux Canadiens mais aussi aux représentants de tous les pays qui participent à la Conférence des Nations Unies sur l'environnement.



L'Honorable Jack Davis
Ministre de l'Environnement pour le Canada

Note de la rédaction

Le présent rapport porte sur l'état de l'environnement au Canada, en 1972. Il ne s'agit pas d'une déclaration de la politique canadienne pour l'avenir. Il a été préparé pour la Conférence des Nations Unies à Stockholm et pour les Canadiens par des fonctionnaires de plusieurs ministères du Gouvernement du Canada, et tente de refléter les recommandations et les commentaires formulés par les gouvernements provinciaux et un groupe choisi de représentants d'organisations privées, d'industries et de citoyens.

Il existe au Canada tout comme dans les autres pays, des opinions variées concernant les causes, les conséquences de la détérioration de l'environnement et les moyens à prendre pour corriger cette situation. Même si la participation des autres gouvernements et des organisations non-gouvernementales a été très utile à la préparation de la présente communication, le texte n'engage qu'Environnement Canada, un ministère du Gouvernement du Canada.

Un rapport aussi restreint ne peut espérer approfondir un sujet aussi compliqué. Pour les personnes qui voudraient étudier ces questions plus à fond, nous soumettons les documents suivants comme partie intégrale du rapport du Canada à la Conférence des Nations Unies sur l'environnement.

Conseil canadien des ministres ressources

Rapport no 1

Comité directeur intergouvernemental sur la pollution, mai 1970

Rapport no 2

Comité directeur intergouvernemental sur la pollution, octobre 1970

J.W. MacNeill

"La gestion du milieu" — Une étude constitutionnelle préparée pour le Gouvernement du Canada

Le Conseil des sciences du Canada

Rapport no 3

"Un programme majeur de recherche sur les ressources en eau du Canada"

Rapport no 7

"Les sciences de la terre au service du pays"

Rapport no 8

"Les arbres . . . et surtout la forêt"

Rapport no 9

"Le Canada . . . leur pays"

Rapport no 10

"Le Canada, la science et la mer"

Rapport no 12

"Les deux épis, ou l'avenir de l'agriculture"

Rapport no 14

"Les villes de l'avenir: les sciences et les techniques au service de l'aménagement urbain"

Rapport no 16

"Mais tous étaient frappés"

Le Conseil des sciences a été créé par le Gouvernement du Canada mais il jouit d'une liberté complète pour examiner, critiquer, commenter, faire des recommandations et publier les ouvrages qu'il juge à propos. Etant donné le caractère indépendant du Conseil des sciences, les rapports qu'il publie ne reflètent pas nécessairement la politique du gouvernement. Ses opinions sont toutefois respectées et étudiées.

Environnement Canada

"Environnement Canada—
L'organisation et ses objectifs"

En résumé

Nous avons fait une appréciation de la qualité de notre environnement au regard de nos caractéristiques géographiques et climatiques et dans le contexte de notre distribution démographique et industrielle. Nous avons identifié certains problèmes sérieux. On pouvait prévoir que ces problèmes ont tendance à se concentrer dans les régions densément peuplées.

Une riposte fédérale-provinciale-industrielle concertée aux problèmes d'environnement s'engage. Certains principes distincts se sont précisés, notamment "garder la pollution à l'intérieur des usines" et "aucun refuge de pollution."

Des lois fédérales et provinciales ont été adoptées pour forcer les nouvelles industries à fonctionner proprement et accorder aux industries en place des délais raisonnables pour rattraper le temps perdu. Nous avons adopté l'attitude qu'il faut faire appel aux meilleures techniques disponibles pour mettre un frein à la pollution et pour la réduire.

Ce changement de valeurs dans les attitudes des Canadiens face à la qualité de l'environnement est illustré par un discours que le Premier ministre Trudeau faisait à Vancouver le 1^{er} mai 1971:

"A une époque où nous savons avec certitude que la biosphère ne peut pas soutenir indéfiniment la vie, où nous nous rendons compte que les ressources dont nous disposons sont limitées, il se trouve encore des gens qui persistent à croire que l'homme fait preuve de génie quand il réussit à vendre des produits dans des emballages de plus en plus attrayants, dont on n'arrive plus à se défaire. Il y a toujours des personnes pour prétendre que les intérêts des actionnaires ou des contribuables justifient le fait de déverser impunément les ordures et les eaux

usées dans les cours d'eau ou de répandre des fumées délétères dans l'atmosphère.

Certes, nous ne sommes pas assez ignorants pour croire que la terre va commencer à produire plus de ressources naturelles, à une cadence inépuisable. Bien sûr, nous n'aimerions pas vivre à côté d'un dépotoir et respirer un brouillard fumeux en contemplant un océan pollué. Croyons-nous vraiment qu'un niveau de vie élevé doit avoir pour corollaire des embouteillages quotidiens et un bruit à vous crever les tympans? Ne pensons-nous jamais au monde dans lequel nos enfants et nos petits-enfants devront affronter la vie? Avons-nous enfin perdu notre bon sens et faussé notre échelle des valeurs au point de confondre le bien avec la consommation, et la qualité avec la croissance?

Les Canadiens peuvent-ils contribuer à résoudre ces problèmes exaspérants, à adapter la métaphysique et l'éthique à une époque technologique? Je le crois.

Le progrès technologique et l'accroissement démographique ont atteint, tous deux, un rythme si rapide que le monde se trouve placé, aujourd'hui, de façon précaire, au seuil de plusieurs courbes exponentielles. La population et la pollution augmentent à un rythme dangereux alors que diminuent à une allure non moins menaçante nos réserves de ressources naturelles et de terres arables. Pendant un quart de siècle, nous nous sommes laissés leurrer par un système de compatibilité fallacieux qui permet à l'industrie, au gouvernement, à l'agriculture — à tous les rouages du pays — de passer certains frais au compte de la société toute entière. Aucun homme d'affaires ne calculerait son bénéfice net sans tenir compte d'abord de la dépréciation des bâtiments de son usine, du vieillissement

de ses machines et de la diminution de ses stocks de matières premières. Pourquoi donc, alors, les gouvernements des pays de l'Ouest continuent-ils à porter aux nues le produit national brut? N'est-il pas temps de prêter attention à l'épuisement des ressources, à la détérioration de l'environnement, aux frais sociaux dus à la surpopulation, à l'amoncellement des déchets? Bref, ne devrions-nous pas reporter la confiance que nous avons dans le PNB sur une donnée beaucoup plus révélatrice, une nouvelle statistique que l'on pourrait appeler le *profit social net*?"

Le Canada n'est qu'un membre de la famille des nations. Les problèmes d'environnement que nous cherchons à régler n'appartiennent pas qu'à nous. Lorsqu'on envisage la position du Canada dans le contexte de l'environnement mondial, il est évident que nous avons un rôle responsable à jouer dans la mise au point de solutions aux problèmes d'importance nationale et internationale. Tout comme les autres pays, le Canada est exposé aux agents de pollution venant de l'extérieur; ses côtes baignées par trois océans, sont exposées aux agents de pollution en provenance d'autres pays. Il n'y a pas de domaine où la coopération internationale s'impose avec autant d'acuité.

On n'a pas encore déterminé les répercussions globales des agents de pollution sur l'atmosphère de la terre. Les déplacements de ces agents de pollution au-delà des frontières politiques et leurs répercussions ultimes sur l'environnement des autres pays et sur les océans est une question qui intéresse beaucoup le Canada. Il n'y a pas de pays où les répercussions sont aussi manifestes qu'au Canada. Au cours des mois d'été, notre territoire est exposé à des vents dominants sud-ouest,

et une proportion importante des agents de pollution de l'air qu'on trouve en Ontario, au Québec et dans les provinces de l'Atlantique vient des États-Unis.

Le Canada reconnaît la nécessité des réseaux de surveillance de l'environnement internationaux et d'une banque de données internationale sur lesquelles on pourrait s'appuyer pour prendre des décisions sages concernant les règlements à adopter. Ce genre de système devrait être conçu de façon à permettre aux gouvernements du monde entier de prévoir les problèmes au lieu tout simplement d'y réagir. Le cycle de la vie est délicat. On sait très peu de choses sur les répercussions de plusieurs produits chimiques qui entrent dans notre environnement. De quelle façon réagissent-ils, individuellement et en groupes? Quelle est leur durée? Non seulement faut-il surveiller les matières dangereuses connues mais des travaux coopératifs de recherche s'imposent pour découvrir les milliers de substances inconnues.

A titre d'importateur et d'exportateur important d'aliments et de denrées alimentaires, le Canada appuie la mise en place d'un programme de surveillance des agents de contamination des aliments. L'homme et la faune sont vulnérables aux produits chimiques qui s'immiscent dans le cycle de l'aliment. Des produits chimiques toxiques entrent dans les aliments de plusieurs façons et se multiplient jusqu'à 100,000 fois. Il est évident qu'il n'est pas nécessaire que le coût de la protection de l'environnement tant au niveau national qu'au niveau international, soit élevé. La technologie est disponible: de nouvelles technologies verront le jour bientôt.

Un autre élément vient s'ajouter sur la scène internationale, soit la répartition des avantages. Monsieur

U. Thant, ancien secrétaire général des Nations Unies, exprimait l'opinion de plusieurs Canadiens dans son allocution à la séance d'ouverture du Comité préparatoire pour la Conférence des Nations Unies sur l'environnement:

"... Une nouvelle civilisation caractérisée par un plus grand nombre d'être humains, une vie plus longue et une qualité de vie améliorée, a fleuri au cours des deux derniers siècles et s'étend lentement au monde entier. On n'a pas encore assuré une justice dans la répartition mondiale de ces avantages. En fait, on s'est grandement préoccupé au cours des vingt-cinq dernières années d'améliorer la participation des pays plus pauvres à ces avantages et de stimuler leur développement.

On vient maintenant de prendre conscience d'une nouvelle dimension inquiétante de l'épanouissement de la civilisation industrielle: l'homme s'est soudainement éveillé aux dimensions, à la rapidité et aux répercussions massives des procédés de production sur les richesses et la configuration de cette planète et sur ses équilibres biologiques de base. L'homme ne peut plus avoir comme principale préoccupation celle de produire à tout prix sans tenir compte des répercussions sur l'environnement. Le contrôle des répercussions des procédés de production nécessitera une nouvelle façon de concevoir l'économie, de nouveaux instruments juridiques, de nouvelles dispositions administratives et de nouvelles priorités gouvernementales. Je suis convaincu que les hommes et les institutions pourront s'unir pour résoudre ce problème; en effet, poussé par la nécessité, l'homme sait s'adapter à de nouvelles conditions."

Hibbs Hole, a typical Newfoundland coastal community whose residents depend on the Atlantic fishery for their livelihood.

Hibbs Hole, une communauté type sur la côte de Terre-Neuve dont les habitants vivent de la pêche.



1 Introduction

La Mauricie National Park, Quebec, one of Canada's newest national parks.

Parc national de la Mauricie au Québec, l'un des parcs nationaux les plus récents au Canada.

Canada is a large country. From east to west it stretches through 86 degrees of longitude; its depth spans 41 degrees of latitude; it covers 3,851,809 square miles. An impressive ecological diversity can be expected in an area covering half a continent. This huge Canadian land mass is composed of distinctive regions, each a unique combination of varying topography, climate, soils, flora and fauna; each offering unique benefits – and unique problems. The challenge is to support a rich and rewarding life in each region while maintaining ecological systems in a healthy and productive state. For its proper use and maintenance, each region requires a special understanding.

Canada is a land of contrasts. It has arctic deserts too cold and exposed to grow most plants. In its more temperate zones lies an industrial heartland surrounded by rich agricultural lands. It has flat, treeless, fertile prairies located not far from wet mountain slopes clothed with dense coniferous forests. These marked ecological differences have largely controlled the pattern of settlement, and therefore the impact that man has had on the environment.

The original Canadians, Indians and Eskimos, distributed themselves in a way that reflected the ability of the land to sustain them. Despite modern technology, today's population pattern is much the same, although at 21.7 million, the population is about 100 times greater. Although he frequently believes otherwise, modern man is not independent of ecological needs. These have been with man since he became man; they are part of his being man. His needs, desires and delights still combine to put predictable patterns of population on the lands of the world.





Grand Coulee, Saskatchewan, in the heart of Canada's grain-growing region.

Grand Coulee, Saskatchewan, au coeur de la région des céréales.



Melville Island in the Arctic Archipelago, site of major oil and gas exploration activity.

L'île Melville dans l'Archipel Arctique où se poursuivent d'importants travaux d'exploration et de prospection pour trouver du pétrole et du gaz.

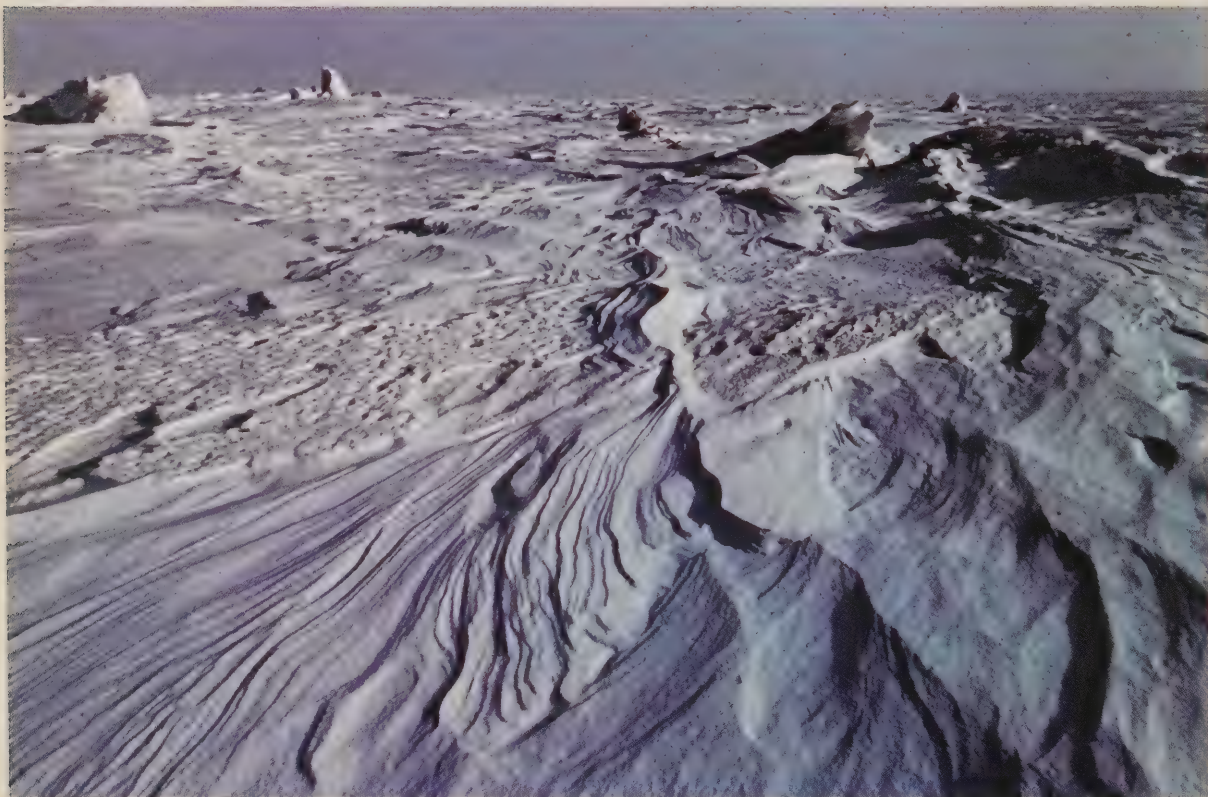
1.1 The Canadian Environment

Most Canadians know Canada as a land of rich farms and industrialized cities, located near the Great Lakes or by the St. Lawrence River, which drains the Great Lakes to the sea. This was once a land of hardwood forests growing in good soils and with climates suitable for agriculture. The hardwood forests grew also in those parts of the Maritime Provinces where the soils now favour agriculture. The St. Lawrence made the Great Lakes basin easily accessible from the sea, and it was on those fresh water shores as well as on

the Atlantic coast that Canada as a nation began to take form. The same St. Lawrence waterway, now with its locks and canals, is today a major route for maritime shipping, stimulating an extensive industrialization nourished by a rich and extensive agriculture.

Most of this large region is now dominated by man and agriculture. Fields have almost completely replaced the hardwood forests. But now cities have begun to spread over the fertile fields. Inevitably this heavily populated area has a large share of Canada's environmental problems.

The central prairies are also dominated by man and agriculture. Almost none of the original grassland remains. Cultivated fields now replace much of the aspen parkland forests that once formed the northern border of the treeless prairies. Unlike the diversified agriculture that replaced the eastern hardwoods, the dry plains agriculture has been concentrated on wheat, and larger farms have been the rule. This kind of agriculture with its lower density of settlement has fostered fewer villages and cities. While intensive use of the land for cereal culture has created en-



Mount Robson, British Columbia, one of the most impressive of the Rocky Mountains.

Le Mont Robson, en Colombie-Britannique, l'une des impressionnantes parmi les montagnes Rocheuses.

vironmental problems, these have been less severe than on the heavily populated hardwood soils to the east.

Canada is a northern nation. While most Canadians live in the temperate south, most of Canada is thinly settled northern landscapes dominated by cold. Two huge regions comprise this major portion of the country: a deep belt of cold spruce forests that cover a large part of Canada from coast to coast, and, to the north, treeless tundra reaching on the Arctic Islands nearly to the North Pole. Man has not dominated these cold regions. When and where the economic circumstances were right, some minerals have been extracted and some trees cut. Extensive recreational use has modified some of the southern fringe of the spruce forests. But in general these regions are only beginning to feel the impact of our technological society. This is a fortunate circumstance. The tundra and spruce forests are impoverished by cold, and are thus unusually fragile. It would have been disastrous to subject these arctic and sub-arctic environments to management and exploitation techniques developed in temperate zones. Now, in an era of greater ecological understanding and concern, there is hope for wise use of arctic lands that will forestall destruction of the landscape.

The western Canadian mountain ranges create extreme and varied ecological conditions. In the north, cold overrides the mountain influences so that spruce forests and tundra are the normal vegetation. In the south, however, the warm ocean winds moderate the climate and send abundant moisture inland. Successive ranges of mountains alternately concentrate the moisture into rainfall on windward slopes and hinder rainfall on leeward lands, resulting in unusually wet and unusually dry landscapes. The wet ones grow

well-watered softwood forests famed for their fast growth and for the large trees characteristic of the original forests. The best and most accessible of these forests have been heavily exploited so that much of the landscape is in various stages of recovery from clear cutting. In these forests scattered towns and villages usually owe their existence to forest industries, mining, or, on the coast, commercial fishing. Alternating with the wet areas are dry lands originally growing grasses or open grassy forests. Some of the driest areas are almost desert-like. These open

ranges have been much modified by livestock grazing. Intensive logging has removed much of the readily accessible forest. Irrigation supports intensive agriculture on some of the warmest, flattest and most fertile areas. Attractive climates, scenic landscapes have made these areas and their fringes the most popular recreational lands in western Canada. The densest populations, and therefore most environmental problems, are on the southern coast where an attractively warm climate and a good transportation system have fostered a growing industrial area.



Canada has long shorelines on three oceans. One of the world's largest continental shelves lies off its Atlantic coast. The Atlantic and Pacific coasts both support large commercial fisheries. The fisheries of the arctic coast yield food for the inhabitants of the area. The problems of protecting the quality of the sea and maintaining proper harvests of its resources result not only from the fisheries based on Canada's coasts, but also from the fishing and shipping activities of other countries. On the Atlantic and Pacific coasts the fishing populations have established numerous small communities, often where no villages could survive if there were no harvests from the sea.

1.2 The Perspective of Time

In an earlier age, the Indians and Eskimos achieved an ecological harmony with the Canadian land. Restricting property to personal possessions, they put little pressure on the land or resources and they had a profound respect for all living things, even those they had to kill in order to live. The traditions of European man – embodying concepts of land ownership and land use and based on an ancient evolution of farm, village and town – were similarly in harmony with the land. But these traditions contained no powerful ethic to direct the wise use of "new" lands. What the Indian and Eskimo considered common lands the newcomers deemed no one's, until it became someone's. A wave of resource exploitation, destructive and largely ungoverned, swept across the country. Where the soils and climate were favourable, the traditional pattern of husbandry took root; elsewhere a painful process of adjustment still continues. A second wave followed, flowing from the demand of a more sophisticated industry, swollen by the technological flood of new processes,



Georgian Bay, on Lake Huron, a wilderness vacation retreat.

La baie Georgienne, sur le lac Huron, un paradis pour les vacanciers.



new wastes and new capabilities. More and more people wanting more and more goods continue to accelerate the pace of change.

Actions beget reactions. Increasing numbers of men extracting increasing volumes of resources from the land and returning increasing amounts of waste to it are sure to create problems in environmental quality. In the Great Lakes-St. Lawrence basin, concentrations of people, industry and agriculture on both sides of the international boundary create severe problems of air and water pollution.

As the changing world of men increased its demands on the land, the village and farm traditions have survived, but not without great change. An accelerating urbanization is now a major characteristic of the settled Canadian landscape as cities grow at the expense of villages and farms. Ecological changes accompanying this trend may be even more important than the more obvious social changes that are taking place.

Across Canada cities grow relentlessly, destroying irreplaceable natural wealth, as subdivisions flow outward over some of the nation's most fertile farmlands. Popular as it is, the city offers environments that can threaten the health and happiness of men and may be increasingly destructive to other environments far beyond its boundaries.

Resource management is outgrowing the frontier myth that common property belongs to he who gets there first and takes the most. Ethics are evolving to support more careful uses of the wilder landscapes, but there is still need to ensure that resource use is not destructive. The "tragedy of the common" – the exploitation of resources that everyone owns, but no one cares for – is not peculiar to Canada. It is an international attitude, as Canada has

learned in its efforts to maintain the quality of adjacent seas and manage the harvests of marine fish and mammals.

Perhaps the most dangerous environmental problems are those least easily seen. It is the resource-rich hinterlands that make urban living possible; yet our increasingly urban society, visually and culturally isolated from its natural surroundings, is in danger of losing touch with its ecological foundations in rural and wilderness Canada. To lose touch is to lose the chance of understanding – a loss we can ill afford. To take an even longer view, environmental problems are imposed on a finite world – a world of fixed space and limited resources. The ultimate challenge is to achieve a quality environment. To do so we must balance human demand and global resources.

1.3 Canada in North America

International aspects of environmental protection are vital for Canada. Canada and the United States share one of the longest boundaries in the world. It runs for 1,000 miles, between Alaska and the Yukon, from the Arctic Ocean in the north to the northeast Pacific; and 5,000 miles from the Pacific Ocean in the west, at the Strait of Juan de Fuca, to the Atlantic Ocean in the east. The boundary passes over arctic tundra, through scenic mountains and forests, across fertile prairies and down through the industrial heartland of North America.

This man-made line has been drawn across the North American continent, arbitrarily in places and following geographical features, such as the great St. Lawrence waterway, in others. Naturally enough, Canada's principal population centres are close to this southern boundary and, naturally enough, some of the largest and most highly industrialized cities in the United States are

only a few miles away. Trade north and south across this boundary is extensive. Because adjoining concentrations of Canadians and Americans share the same air masses and watersheds, they also share many problems of pollution abatement and environmental control.

The movement of people, goods and services across the international boundary forges economic links. It also necessitates a co-operative response to such challenges as the eutrophication of Lake Ontario and Lake Erie; the northward spread of Dutch elm disease; and the destruction of the fishery in the Saint John River, between New Brunswick and the State of Maine.

A joint approach – a joint international approach – frequently calls for a joint declaration of intentions and a common plan for dealing with human, agricultural, industrial and other wastes. Compatible standards and similar means of enforcement are essential. Fortunately, both countries have been able to work out common objectives and a common approach to pollution in many fields. The accomplishments of the International Joint Commission are note worthy, not only in resolving differences of a legal or an economic nature, but also in providing sound advice on environmental matters to both the Canadian and the United States governments.

1.4 Canada – A Federal State

Canada is a federal state, not a unitary state. It has two levels of government, not one. It has a national government with its capital in Ottawa, Ontario. It has ten provincial governments with their capitals scattered from coast to coast and two northern territories administered by the federal government.

Responsibilities for environmental management were not assigned in the constitutional division of powers be-

The Canada Centre for Inland Waters, Burlington, Ontario, focus of much of the research on Canada's fresh water.

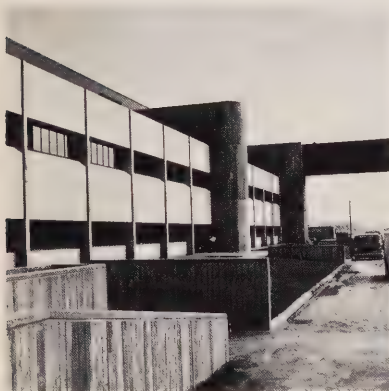
Le Centre canadien sur les eaux intérieures, à Burlington en Ontario, où se poursuivent la plus grande partie des travaux de recherche sur les eaux douces au Canada.

tween the federal and provincial governments. The legislators who framed the British North America Act (the basis of the Canadian constitution) in 1867 did not foresee the future magnitude of these present-day concerns. The Parliament of Canada was given certain powers relating to coastal and inland fisheries, transport, trade, taxation, and criminal law (which has been interpreted to include environmental matters national in scope). Unless they are privately owned, most natural resources within provincial boundaries belong to the provinces. These include land, water,

minerals, timber, wildlife and, to an extent, air space. Their regulation and use is largely under provincial jurisdiction. Other matters of property and civil rights are also a provincial responsibility. Although the federal government will play a leading role in working towards a cleaner environment, legal responsibility for preservation and enhancement of our surroundings is shared in varying degrees by governments at the federal, provincial and municipal levels. Both senior levels of government have a wide variety of legislative powers, while municipalities have powers and

responsibilities assigned to them by provincial legislatures.

In comparison to the rights of provincial governments, the property rights of the federal government are limited with respect to resources located within a province. The federal government owns national parks, canals and certain other property within provincial boundaries. It can also acquire resources by purchasing or expropriating them for purposes within its legislative jurisdiction. In addition, the federal government owns all crown rights to resources lying outside provincial boundaries—



that is, in the northern territories. Both senior levels of government are involved in certain areas of jurisdiction, such as water management and agriculture. Effective response to the challenge of pollution depends not simply on a fixed jurisdictional framework, but on flexible co-operation between the federal and provincial governments, working together in pursuit of common objectives on programs of joint interest.

Over the years, a useful division of labour has sprung up between both levels of government in important fields not mentioned in Canada's 105-year-old constitution. To be more specific, the federal government does most of the research in fields like wildlife, fisheries, forestry, agriculture, geology and urban development. It does this in a variety of research institutes, centres of excellence and of expertise, located in all parts of the country. On the other hand, the provincial administrations, being close to the scene, are generally responsible for regulation on a local scale and play a major role in pollution abatement and control. In some circumstances the provincial programs provide a lead to national programs both in Canada and other countries.

Today, the federal government has authority to deal with pollution problems that spill over provincial and international boundaries. In practice, it has worked with the provinces in tackling these problems.

In the field of urban affairs and housing, the federal government lends money and guarantees loans for building houses as well as trunk sewers and sewage treatment plants. Federal loans are available up to a maximum of two-thirds of the cost of municipal sewage systems. Of this, 25 per cent can be forgiven. Some provincial governments have similar programs.

It is clear that environmental matters do not fall under separate federal and provincial headings. Co-operation is the key word in concept, planning and execution. This parallels the reality that the human environment is one and indivisible. No division of powers, either between nations or between different levels of government, can or should be an obstacle to its protection and enhancement. In Canada, programs which are developed jointly and administered, as much as possible, at the local level seem to provide both the institutions and the answer.

1.5 Some New Institutions

Public demand for the creation of new laws and new institutions to preserve and enhance the natural surroundings has been growing. As a result, a good deal of legislation concerned with the environment has appeared on the statute books. Since 1968, for example, the Canadian Parliament has enacted the following laws having national and international implications:

- Canada Water Act
- Clean Air Act
- Federal Fisheries Act (amendments)
- Canada Shipping Act (amendments)
- Arctic Waters Pollution Prevention Act
- Northern Inland Waters Act

A new Department of the Environment was created in 1971. It brought together in a single ministry a host of agencies involved in the management of renewable resources and the natural environment. These agencies work in the following fields:

- Meteorology and atmospheric research
- Water management – fresh and marine
- Fisheries
- Forestry
- Wildlife
- Land use and inventory
- Environmental protection

Special advisory councils were created to provide government with advice on environmental matters from industry, the universities and the public at large.

The year 1971 also saw the creation of the Ministry of State for Urban Affairs. It received a mandate to develop policies within the field of federal jurisdiction with respect to:

The most appropriate means by which the Government of Canada may have a beneficial influence on the process of urbanization in Canada.

The integration of urban policy with other policies and programs of the Government of Canada.

The fostering of co-operative relationships in respect of urban affairs with the provinces and, through them, municipalities, with the public and with private organizations.

This mandate, together with the role of the new ministry in policy development, research and co-operation, will supply a much needed emphasis to the identification and control of Canada's urban problems.

The provincial governments have been similarly engaged in passing new legislation and reorganizing departmental functions. In all ten provinces reorganization is resulting in new institutions for environmental management. In Alberta, for example, the formation of a new Department of the Environment was accompanied by enactment of the Clean Air Act, the Clean Water Act, the Environmental Research Trust Act, and the Beverage Container

Act. Administration of these and other legislative measures already in force are now the responsibility of the new department. The principal pieces of environmental legislation from the provinces are listed together with a similar federal list in Appendix I.

Liaison between the provinces in respect to provincial matters and between the provinces and the federal government has been aided by the creation, in the early 1960's, of a Canadian Council of Resource Ministers (now the Canadian Council of Resource and Environment Ministers). This Council provides a forum in which common problems can be discussed. While it cannot enact legislation, it can help to develop policy by organizing conferences on a national scale and by acting as a clearing house for ideas.

The British Columbia forest industry is a major contributor to the Canadian economy. Typical is the Elk Falls pulp and paper mill, Vancouver Island.

L'industrie forestière de la Colombie-Britannique constitue un élément important de l'économie canadienne. L'usine de pâtes et papiers de Elk Falls sur l'île de Vancouver.



Some of the world's biggest deposits of iron ore are found in Labrador.

Le Labrador renferme certains des plus importants gisements de fer au monde.

2 Some Fundamental Questions

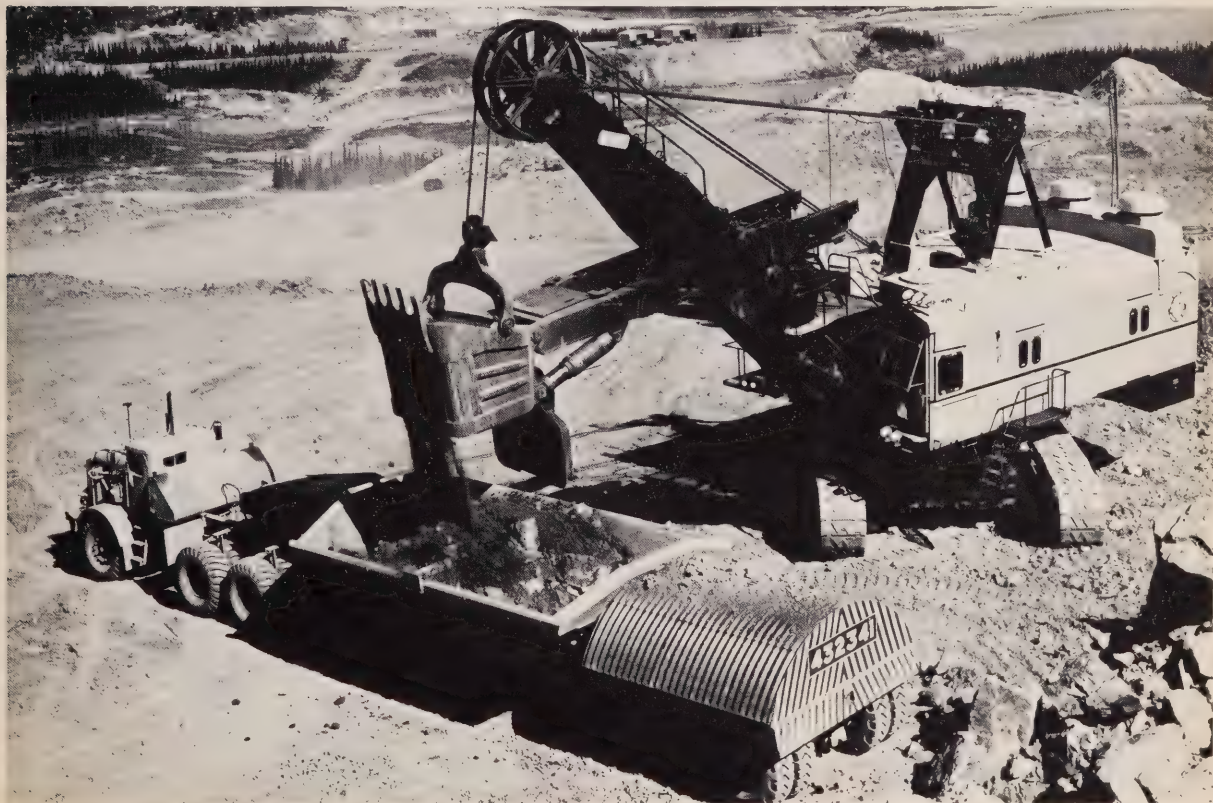
Those who are concerned about the quality of life in Canada have been asking themselves some fundamental questions. These relate to the rate of economic growth, the nature of industrial growth, urban concentration, the trends of non-renewable resource development, the way in which modern clean-up technology can be employed, and the standards which must be set to ensure a safe and healthy environment and prevent the creation of "pollution havens".

2.1 Economic Growth and a Healthy Environment

Most Canadians believe they can have economic growth and a healthy environment for some time to come. But environmental factors must be considered in planning and decision-making. Those who are responsible for economic decisions must take a much broader and longer view than has been customary. Decision-makers must recognize and respect social priorities and take into account the environmental degradation their decisions may cause. They must take care to minimize dis-

ruption of the natural environment, not only in the short run but as far ahead as can be intelligently foreseen.

In other words, environmental design is required in the engineering of a new project, in the creation of a new industry, or the establishment of a new town. Such design must proceed in parallel with traditional engineering activity. A pipeline should be located to avoid biological disruptions. Roads should be built across the permafrost so that they will not damage the tundra. Pulp mills must not be built without regard to salmon streams. Hydro



This gas separation plant is part of Alberta's oil and gas industry.

Cette installation pour la séparation du gaz fait partie de l'industrie du gaz et du pétrole de l'Alberta.

projects which inundate huge areas should be questioned if nuclear power plants can provide electricity without increasing pollution. A high degree of sewage treatment must be provided.

With proper planning and location, new developments can be compatible with nature. Some processes may stimulate natural growth by fertilization or by warming the environment. They may help place forestry and fisheries on a sustained yield basis. Developments which have environmental benefits should be encouraged not only because they help create a healthier environment, but also because they make economic sense in the long run.

Yet there are conflicts. There are "hard" industries and "soft" industries. Hard industries, typically, produce products which are unnatural products, generally from chemical processes which can poison the surroundings. Even when dispersed, these products may be concentrated in living things and, therefore, endanger those forms of life which are at the end of the food chain. Soft industries, on the other hand, use procedures and generate products which are less offensive from a biological point of view. They degrade easily. They recycle easily. They are natural in the sense that they already exist in nature or are readily assimilated by living things in or close to the areas in which they are produced.

Even soft industries, like pulp and paper, fishing and certain kinds of agriculture, can present environmental problems. They are usually problems of concentration. They concentrate too much organic material in one place, and the decomposition of that material places a heavy demand on oxygen in the waters. They can suffocate life. The location of these activities, their intensity and the methods they use before and during dispersal must be controlled to en-



sure that they have a positive rather than a negative effect on the environment in which they are located.

Canada has a good share of hard industries. Metal mining is a very important activity, especially in the Canadian Shield around Hudson Bay and in the Western Cordillera, which stretches through most of British Columbia and the Yukon. Metal smelting and refining have left scars on the landscape around such communities as Sudbury, in the nickel belt of Ontario, and Trail near the Canada-United States boundary in southeastern British Columbia. Strip mining and gravel pits have pock-marked the Canadian countryside.

But in recent years bad practices have been discontinued, some smelter-gases have been converted into fertilizers, some waste chemicals recycled and some open pits landscaped, especially in areas which are becoming more accessible to the tourist and the week-end vacationer.

Not only is hard industry growing faster than soft industry in Canada, but hard industry is becoming increasingly oriented towards chemical processes. It is expanding in both volume and variety. Hundreds of new chemical substances are being manufactured each year, and, because many are toxic, it is becoming imperative to contain or recycle them.

Certainly releases of toxic chemicals into the environment must be kept to a minimum. Effluent standards now being introduced by the federal and provincial governments are being set with this end in view.

We can look ahead into the 1980's with reasonable optimism. New industry will be cleaner — much cleaner — than old industry. New chemical substances will be confined, as much as possible, to the mills and factories themselves. In the 1960's much was achiev-

ed by Canada's cities and towns in the treatment of sewage. By the end of the 70's they will all be providing a high degree of effluent control. By then also, Canadians will be driving motor vehicles which are relatively pollution-free. The volume of pollutants being released into Canada's great outdoors will be down. It will be down even though total industrial output to the nation may well double between 1972 and 1985.

2.2 One Standard or Many?

The general applicability of standards for pollution control remains a controversial question. The concept of minimum standards, developed industry by industry and uniformly enforced from coast to coast, has many advantages. But there are arguments against this approach. There are those who advocate the "dispersive capacity" approach. They hold that uniform standards ignore the natural advantages of one location and the special problems of another. There are obviously locations, in remote interior or northern areas, or on large bodies of water or subject to strong, prevailing winds, where wastes from an industry or a large city or town can be dispersed without apparently damaging the local environment. Proponents of the dispersive capacity approach see little or no need for treatment in these areas. Thus, expensive treatment plants, which might be needed in other locations, would be unnecessary and clean-up costs minimal.

Critics of the dispersive capacity approach say that:

(a) No one knows, for certain, the capacities of a given environment, least of all those of particularly sensitive environments such as the tundra. Some substances are persistent and may be accumulated in food chains to a dangerous degree.

(b) A single installation may be all right. But if it is enlarged to double or triple its initial size, the effects may be unfortunate. Unless the initial layout provides for the necessary clarifiers, treatment ponds, air scrubbers, recycling equipment and the like, the over-all clean-up costs could exceed those which would have been incurred had the operation planned for proper treatment at the outset.

(c) The arrival of other industries at a later date may produce a synergistic effect on an area. In other words, the combined effect of discharged pollutants could be greater than the sum of the effects that are associated with the separate discharges.

(d) It is inequitable that one industry or municipality be obliged to treat its wastes to at least a minimum standard while others of similar size and character get away scot-free. This argument, of course, applies with particular force when more than one province or municipality are in competition for industries or other forms of development. A municipality or province which uniformly enforces minimum standards risks keeping certain industries out of its territory. A municipality or province which relies on a dispersive capacity approach can better attract industry, create jobs and improve revenue, but only at the expense of its neighbours.

A similar but more stringent approach is based on the concept of the "assimilative capacity". This approach allows the disposal of wastes into the environment only to the extent that their local and global effects never exceed the capacity of the biological, geochemical and geophysical processes of restoration. This approach has special application to the world's oceans, although we still have much to learn about their assimilative capacities.

Environment Canada is developing minimum standards as one of its approaches. These minimum standards, which are being enforced in all areas of federal jurisdiction, reflect the best practicable technology. They are practical standards, worked out in close consultation with the industries concerned and the provincial pollution control agencies. The result is a set of standards tailored to each process and product or group of products. They apply, as soon as new regulations are published, to all installations built after the publication date. Installations existing at the time

of publication will be given a reasonable amount of time to comply. This is because existing plants may be expensive to convert; some may be impossible to clean up; their processes may be outdated; they may be too small; they may be badly located or poorly financed. There must be reasonable time for adjustment.

The minimum standard approach – the best practicable technology approach – is fine as long as the discharge from a proposed plant or city is not out of proportion to the amount of water or air available in the immediate neigh-

bourhood. In other words, the local environment must be able to maintain its quality under the impact of effluents set according to minimum standards. But using even the best practicable technology, it is possible to damage the local environment. In such cases stronger measures are called for. More stringent standards must be introduced. These may incur substantially higher costs and create a financial deterrent.

In remote areas, it is particularly important to introduce environmental design and control to protect the social and economic base of native peoples.



Wastes from a pulp and paper mill pollute this stream near St. Catharines, Ontario.

Les déchets d'une usine de pâtes et papiers polluent ce cours d'eau près de St. Catharines, en Ontario.



Work crews clean up an oil spill in Toronto harbour, where ships from around the world arrive through the St. Lawrence Seaway.

Des équipes de travailleurs nettoient un débordement de pétrole dans le port de Toronto fréquenté par des navires de tous les pays du monde qui empruntent la voie maritime du Saint-Laurent.

They must have a clear option between their traditional way of life and the industrial way of life. On the other hand, some localities in Canada are already too congested. They are overpopulated. Too many industries are huddled together and too many noxious substances are discharged within a comparatively small radius. Unfortunately, the plants may also be located on fresh water with limited assimilative capacity.

That is why it is necessary in some of the more populous and industrialized parts of Canada to introduce standards which are more stringent than the minimum federal standards. The federal government may also have to insist on more stringent standards in areas under national jurisdiction. In other words, local conditions can have an overriding effect, resulting in the application of standards much higher than the minimum.

2.3 Some Economic Consequences of Environmental Control

Wastes are materials that we tend to throw away. They have no recognized economic value to the operator of the process that causes them. But as recovery and recycling operations are perfected, wastes may cease to be wastes and become useful materials. Wastes not only lack positive value to producer and user; they may, in actual practice, impose a cost on those who live downstream or downwind from their source.

To put it another way: wastes which are discharged from one location may impose costs on the community as a whole. Ignored for a time, these external costs may eventually become unbearable. The firm, or the municipality, which has caused these costs must then make amends. When it is forced to remove the source of pollution, this adds to the expense of its operation.



Fortunately, these external costs (costs which must now be internalized by better environmental control) are not large for most industries. In Canada, the costs may be as high as 3 per cent of gross income for the pulp and paper industry, for certain mines and for some chemical plants. The maximum cost is 1 per cent for most manufacturers and less than .5 per cent for most service industries.

The enforcement of uniform standards on a national or province-wide basis is thus unlikely to have a serious effect on primary or secondary industry in Canada. Industry can still make a reasonable profit without adversely affecting local surroundings or imposing exceptional cost on others. In fact, the long-term costs of excessive pollution are often many times greater than the cost of taking proper precautions to prevent it.

Social problems must also be taken into account. A sudden imposition of new standards could be disastrous to isolated communities. Unemployment and dislocation are two factors taken into account when abatement schedules are negotiated. Slippages may occur, depending on changing circumstances. Another factor is that sooner or later, old plants become redundant. However, before they are phased out by changing technology and the forces of supply and demand, Canada's new tax provisions may cause these facilities to be replaced by installations which conform to the new standards for pollution control.

The Canadian government provides two kinds of tax relief for industries installing waste treatment facilities. Recognizing that the cost of pollution control or detection equipment is essential production cost, the federal government exempts such equipment from a 12 per cent sales tax. Another

tax relief is an accelerated two-year depreciation allowance under the Income Tax Act for all new water and air pollution control equipment and facilities. This is interesting in that it not only applies to equipment acquired to achieve clean air and water in presently operating plants, but also can apply when a firm eliminates a process or a plant which is polluting and replaces it with another process or plant which operates cleanly.

Installing equipment to clean up an outdated plant may sometimes be more expensive than building a new plant with modern clean processes. The Income Tax Regulations permit this investment cost to be deducted 50 per cent each year over a two-year period from profits before calculating income tax. This has the effect of hastening the dismantling of old facilities and encouraging the construction of new facilities which meet the highest standards of cleanliness that modern technology can provide. It provides an incentive to firms to make the necessary changes immediately – and provides, in addition, opportunities to build more modern and efficient facilities.

2.4 Compensation – Who Pays?

The question of compensation for damage caused by pollution has yet to be answered adequately in Canada. Present Canadian law cannot meet the total challenge which the desire for greater environmental quality imposes. Our concern about perceived damage has outpaced our ability to quantify it, identify those who have suffered from it and those who have caused it. But some steps to correct these weaknesses have recently been taken by governments.

Commercial fishermen affected by oil spills from ships in Canadian waters can now look to the new Maritime Pol-

lution Claims Fund set up under the Canada Shipping Act. But for others, recourse must be sought in the courts. Damage must be proven and, to the extent that the ship-owner is unable to settle claims, the Fund is called upon as an unsatisfied judgment fund. The new Fund is based on a levy imposed on all oil moving in and out of Canadian ports. The levy was established at the outset on all oil moving in and out of Canadian ports at 15 cents a ton, but it may be varied on the basis of experience. The Fund could amount to \$25 million by 1976.

With such a fund in existence, it is possible for the federal government to pay claims made by commercial fishermen for the loss of income they suffer through damage to the fishery from oil pollution without the government necessarily having to sue the oil companies or take these payments out of the revenue which it collects from other Canadian taxpayers. Also, the government will be able to recover its costs of clean-up of oil spills if they exceed the amount recoverable from the ship-owner.

Steel mills on the Hamilton, Ontario, waterfront are sources of air and water pollution.

Des aciéries à Hamilton en Ontario sont des sources de pollution de l'air et de l'eau.



3 The National Response

3.1 Organization and Objectives

Canadian governments at all levels have recognized that the world has not properly assessed the social, economic and physical impact of pollution and technological growth on the environment. It is recognized that governments at all levels, both nationally and internationally, must develop the will to attack environmental problems, many of which urgently require attention.

That the government sees environmental management as an important activity is apparent from its creation of a new department, Environment Canada. Built around the old Department of Fisheries and Forestry, it now includes the Meteorological Service from the Ministry of Transport, the Air Pollution Control and Public Health Engineering Divisions from the Department of National Health and Welfare, the Water Sector from the Department of Energy, Mines and Resources, the Canadian Wildlife Service from the Department of Indian Affairs and Northern Development, and the Canada Land Inventory from the Department of Regional Economic Expansion.

The new ministry was officially created on June 11, 1971. It is responsible for environmental protection at the federal level and management of those renewable resources under federal jurisdiction.

Technically and scientifically oriented, it employs more than 25 per cent of all the scientists in the federal public service; it is also action-oriented. Not only is it extending its air monitoring and water monitoring networks to the outer limits of Canada, it has also published Air Quality and Water Quality Objectives against which source emission and effluent standards can be set. Various pollutants have been identified and their use either prohibited or reduced, depending upon their effect on

the environment. New regulations will ensure that federal government establishments meet or better effluent and emission standards set by the three levels of government. Regulatory standards for machinery and equipment manufactured in or imported into Canada are also being developed. In addition, national programs for solid wastes management, noise control, collection and disposal of environmentally hazardous materials, ecological protection, and control of the production and use of environmental contaminants are being considered.

The Ministry of State for Urban Affairs is also a newly created ministry. Smaller than Environment Canada, it has been set up to design and co-ordinate urban-oriented policies and programs administered by other departments and agencies.

In 1970, the federal government approved a program to establish scientific criteria, or tolerance levels, for a broad range of environmental contaminants. Such criteria are fundamental requirements for setting environmental quality standards. This program is under the National Research Council's



Associate Committee on Scientific Criteria for Environmental Quality.

A number of federal departments – including National Health and Welfare; Transport; Agriculture; Energy, Mines and Resources; and Indian Affairs and Northern Development – retain responsibility for functions that have environmental implications.

3.2 a Atmospheric Monitoring System and Techniques

Management of the atmosphere can be effective only if systems and techniques for monitoring the quality

of air, the influence of air quality on climate and weather, and the interchange of pollutants between air, land and water are available. Canada is co-operating with the World Meteorological Organization in the establishment of a global network of baseline air quality monitoring stations. Such stations will gather the information needed to identify current levels of pollution and long-term trends. As its contribution to the network Canada is considering three baseline stations and seven regional stations. In addition it is planning one or two reference stations in each

major metropolitan area to determine long-term trends in the quality of urban air. Remote sensing techniques are becoming increasingly useful to atmospheric monitoring systems, amplifying and extending the data recorded at the network of meteorological stations.

b National Air Pollution Surveillance Program

A knowledge of the nature and extent of air pollution across Canada is fundamental to the sound planning of control and abatement programs. The purpose of the National Air Pollution

National Air Pollution Surveillance Network
(January, 1972)



Surveillance Program project of a number of federal departments and provincial governments is to monitor and assess the quality of the ambient air in the populated regions of Canada on a continuing basis. As data accumulate, the program will become more useful. It will be possible to define long-term trends in air pollution levels and relate these trends to changes in industrial activity and population density as well as to progress in air pollution abatement. Information collected can be used in epidemiological studies and to provide background for the continuing

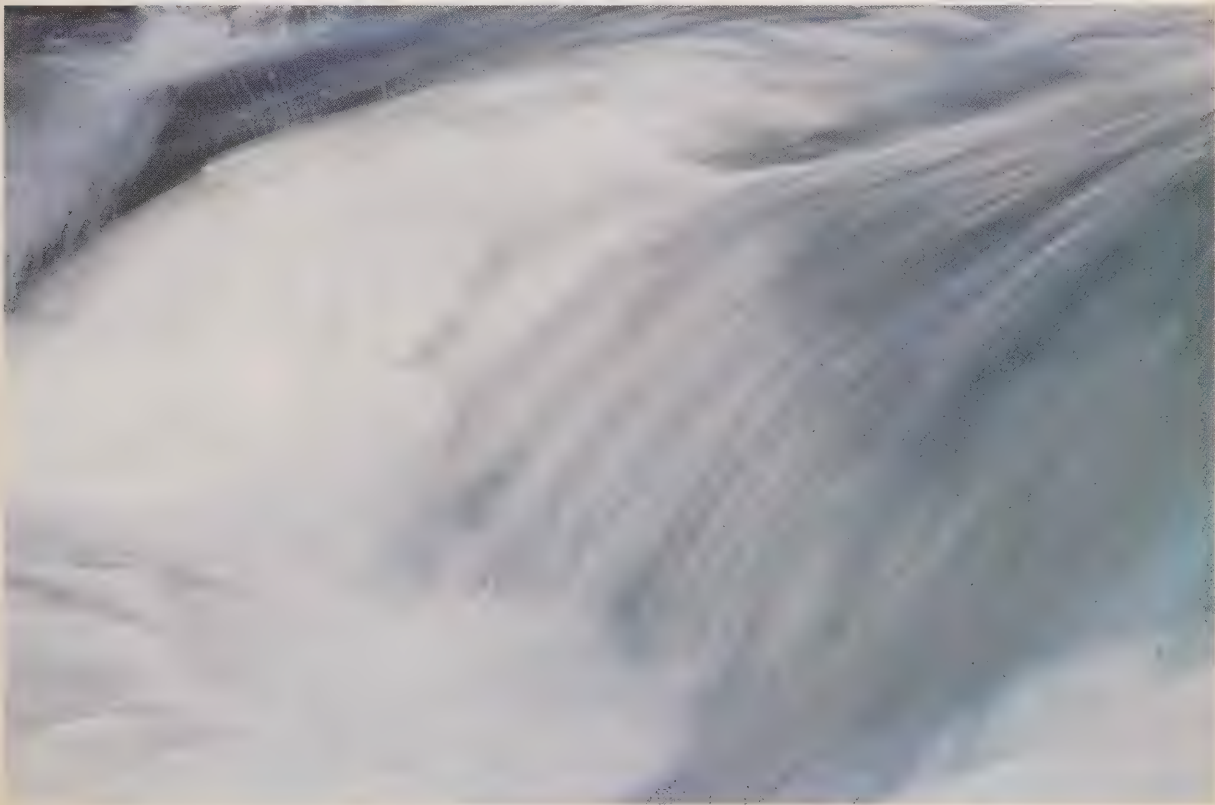
development of air quality objectives.

By the end of 1971 the program had 237 sampling instruments in 36 cities across 10 provinces (see map). Measurements are being made for soiling index, sulphur dioxide, dustfall, sulphation rate and suspended particulates. Data are gathered by co-operating agencies across Canada and forwarded for monthly summarization to Environment Canada.

3.3 Water Monitoring Systems and Techniques

Monitoring networks across Canada provide baseline data on the flow in river systems, on the levels of lakes and tidal waters, and on the quality of water throughout the major watersheds of Canada.

The hydrometric network, set out first in 1894, consists of 2,857 gauging stations and 133 water level stations. Sediment transport data are collected at 133 of the 2,857 gauging stations. Two major projects were begun in 1966: historical hydrometric data are



now stored on magnetic tape and automated computational procedures have been developed.

The growing demand for information on the availability and run-off of water—particularly in watersheds where flood threats recur or in areas where water is scarce—calls for continuing revision of the network.

The Water Survey of Canada, which operates the hydrometric network with the co-operation of the provinces, also surveys seven Canadian glaciers by terrestrial photogrammetry to determine over-all volume changes and learn more about the contribution of glaciers to surface water run-off. Information on volume changes is submitted to the International Association of Hydrologic Sciences.

A federal water quality monitoring network was established in 1966 to provide data from approximately 800 sites on major river and lake systems. As stations in this network coincide, for the most part, with hydrometric gauging stations, the quality parameters can be quantitatively evaluated. The network is being continually expanded to meet the needs of water supply and water-oriented resources management. It is expected that by 1974 data will be obtained on a repetitive basis from some 2,000 selected sites.

Regular nutrient analyses—and sanitary, chemical and bacteriological analyses, as required—are made at stations throughout the Great Lakes system and on most of the major watersheds that are locations of heavy industrial and urban development. Data on heavy metal and other toxic elements are also obtained from a number of stations situated across the country.

Oceanographic data collected from selected stations on the Canadian east and west coasts form the longest time series of certain oceanographic

parameters ever taken. Canadian oceanographic, hydrographic and fishery research vessels operate regularly off Canada's coasts and add to the body of knowledge describing the marine environment. Our ability to predict oceanographic parameters is varied. For example, we can quite accurately predict tidal phenomena, but we are less advanced with respect to marine pollution.

The importance of the oceans because of their influence on the world's climate and their use as the ultimate sink for waste disposal has now been realized. National and international studies of the interaction of the oceans, atmosphere and land are now being undertaken. Canada is participating in a pilot project for the acquisition and dissemination of real-time bathythermograph data under the auspices of the Intergovernmental Oceanographic Commission, as part of the Integrated Global Ocean Station System (IGOSS) program.

A Fisheries Intelligence Service began on Canada's Atlantic coast in April 1972. Fishing vessels are pooling oceanographic, weather and fisheries information. This information is used by fishing fleets to increase their efficiency, by national and international agencies to analyze and forecast environmental conditions, and by researchers to define factors affecting fish populations and movements.

Air and water monitoring are only part of the picture as far as human health is concerned. The Department of National Health and Welfare conducts extensive food and radiation monitoring programs and is responsible for assessing the potential hazards to human health resulting from widespread environmental pollution.

3.4 Remote Sensing

Scattered observation sites cannot provide all the information required for monitoring day-to-day changes in environment. Surveys of broad areas or of the whole country are needed. Canada has pioneered in aerial surveys and has been in the forefront of the promising new technology of remote sensing. The Canada Centre for Remote Sensing, operated by the Department of Energy, Mines and Resources, is the co-ordinator for surveys of the environment from aircraft and satellites. The Centre has established a comprehensive receiving station at Prince Albert, Saskatchewan, to collect data from orbiting or stationary satellites that will view all of Canada. Data processing facilities in Ottawa will make information from any part of Canada available to both government and private users on a real-time or near real-time basis.

Remote sensing techniques use various means to measure temperature, reflectivity and radiation from vegetation, soil, water or snow. Subtle changes in vegetation, such as a slight shrivelling of leaves because of disease, or changes in moisture of the ground, or the dispersion pattern of a plume of smoke or an oil slick can be detected more accurately from a high altitude than from ground level. The extent of snow cover, ice on rivers or the ocean, the movement of icebergs, or the migration of a herd of caribou can be easily checked in any part of the country. Remote sensing is ideal for obtaining detailed information required at specific times and locations. For information required on a synoptic basis, regardless of season or distance, satellite surveys are the only practical and economic method.

By mid 1972 the Prince Albert observatory will be receiving observations on a number of wavelengths in suffi-

cient detail to show every farm field. These observations will be received from a satellite that orbits the earth roughly every 2 hours and covers every part of Canada every 17 days.

Airborne radiation thermometers are now being used for regular surveys of water temperature of the Great Lakes and several inaccessible northern lakes. Data on ice are obtained by air reconnaissance of navigable waters within and contiguous to Canada, as well as from a network of 142 shore stations reporting on freeze-up and break-up.

Canada will soon be using satellites to relay information about stream flow, snow depth in avalanche-prone or water-supply areas, radioactive fallout and other phenomena measured by ground-based instruments.

3.5 Air Quality Objectives

The Government of Canada has proposed national air quality objectives to protect public health and welfare by setting limits on levels of pollution in the ambient air. Regulations are being developed to establish legally enforceable emission limits for air pollutants which constitute a significant danger to health.

The proposed air quality objectives, developed in co-operation with provincial authorities, were based upon a review of current scientific knowledge. In establishing "desirable", "acceptable" and "tolerable" levels for each major pollutant (Chart I), the objectives are believed to be unique. The establishment of different levels is a realistic approach. It acknowledges the existence of clean and polluted areas but provides for uniformity throughout the country as a long-term goal. The national goal will be to bring all parts of the country within the "desirable" range, but this will take time. The concept provides a sound base for an anti-

degradation policy for the unpolluted parts of the country, while clearly indicating the long-term targets for urban areas.

The use of three ranges enables the setting of priorities in tackling the pollution problem. Immediate control and abatement action would be taken in areas where the maximum tolerable limit is exceeded, and high priority would be placed on other areas in the "tolerable" range.

The extent and sophistication of surveillance programs will increase as the pollution levels increase from the

"desirable" through the "acceptable" to the "tolerable" range. In the "tolerable" range, the surveillance system would be designed not only to identify time trends, but also to specify the major contributions to pollution.

The *maximum acceptable limit*, or "tolerable" range, represents the immediate, realistic objective for all parts of Canada. When this level is exceeded, a regulatory agency will take control action. This level corresponds to the secondary air quality standards recently announced by the United States and to air quality objectives established by

National Air Quality Objectives

Desirable Range	Acceptable Range	Tolerable Range	Intolerable Range
Spot Air Quality Measurements	Continuous Monitoring Starts	Control Action Starts Increased Surveillance	
Detectability Level	Maximum Desirable Limit	Maximum Acceptable Limit	Maximum Tolerable Limit

An abundant supply of clean, fresh water is vital to Canada's growing cities.

Une source abondante d'eau douce fraîche est essentielle aux villes en pleine expansion du Canada.



some provinces in Canada. This level is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being.

3.6 Water Quality Objectives

Water quality objectives are a basic feature of water management in Canada. They are statements by governments of the quality levels suited to the uses intended for a specific body of water. When coupled with targets for their achievement, they become the basis for determining the kind and degree of waste treatment and waste control measures needed on ship or shore. In this way, objectives are translated into scheduled action.

The Canadian government has used objective-setting in reaching accords with provinces and the United States for joint water quality management. Common water quality objectives for the Great Lakes, agreed upon by Canada and the United States, are discussed in section 4.2. Some provinces, such as Saskatchewan and Alberta, have already adopted common water quality objectives.

The federal Fisheries Act prohibits the discharge of deleterious substances to waters frequented by fish. Regulations under this Act relate specifically to the observed toxicities of certain effluents. For example, the pulp and paper effluent regulations provide that when a sample of a sensitive species of fish (such as rainbow trout) is exposed to a 65 per cent concentration of effluent, 80 per cent of the sample must survive for at least 96 hours. The stipulation of a 65 per cent effluent concentration is stringent, but it is necessary if fish are to be protected from insidious sublethal effects.

3.7 Phosphates in Detergents

National action to control water pollution from detergents has been under study in Canada since 1970. This action was precipitated by progressive deterioration in the quality of natural waters, particularly the lower Great Lakes — the world's largest accumulation of fresh water (see section 4.2). Studies have shown that phosphorus is the key controllable nutrient in many lakes in Canada. A few years ago about one-half of the phosphorus in sewage effluents in Canada came from ordinary household detergents. When the Canada Water Act was passed in 1970 it provided for control of manufacture or importation of cleaning agents containing nutrients. This provision was used in 1970 and the first regulation restricted the phosphorus content of laundry detergents (expressed as P_2O_5) and reduced by almost one-third the quantity of phosphates derived from detergents and discharged as waste.

Federal-provincial agreements provide for financial assistance to accelerate the construction of advanced waste treatment, and nutrient removal systems. This will result in the removal of more than 80 per cent of the phosphorus from waste waters passing through treatment plants in selected locations.

Restrictions on phosphates in detergents caused the manufacturers to speed up their search for alternative builders in washing products. The most favoured alternative was to use sodium nitrilotriacetate (NTA) to replace some of the phosphate. NTA was tested by the producers to a greater extent than was usual for detergent components to show that it was safe for use. After widespread use of NTA had begun in several countries, speculation increased about possibly harmful health and environ-

mental effects. Existing research programs were speeded up and additional programs started. In the absence of conclusive evidence there was no consensus on the interpretation of results, but decisions were made. In Canada, the use of NTA at a low level was not restricted while research into its effects was ongoing. The evidence is that the aquatic environment adapts to the presence of NTA. Although it is a synthetic, NTA is readily biodegradable. There are still questions about the effects of NTA in special circumstances, but earlier fears about its health hazards were, apparently, greatly exaggerated.

If the environmental effects of detergent components had been thoroughly studied 25 years ago, the problem of phosphate-induced eutrophication might have been managed more easily.

3.8 The Mercury Crisis

Mercury was first publicly recognized as a problem in Canada in 1969, when game birds shot in Alberta were found to contain residues of dimethyl mercury, widely used as a fungicide to treat seed grains. The hunting season was closed and all uses of this toxic and persistent chemical were phased out.

The more widespread and serious problem of mercury in fish was discovered that year when abnormal amounts of mercury were found in fish taken from the Saskatchewan River-Lake Winnipeg system. Recognizing this as a serious threat to human health, and also to the fishery, the Canadian government immediately impounded all fish caught from the Saskatchewan River systems. Fish were analyzed daily and only those with less than 0.5 ppm mercury, wet weight of muscle tissue (interim federal standard) were released for sale. All others were incinerated. More than one million pounds of fish

were destroyed. Although research revealed varying levels of mercury occurring naturally in Canadian lakes and rivers, the source of the mercury which so seriously affected this Canadian freshwater fishery was traced to a chlor-alkali plant in Saskatchewan.

Mercury pollution of fish has occurred in British Columbia, Quebec, and northwestern and southern Ontario. The affected provinces have taken action to reduce discharge. Mercury pollution was subsequently discovered to be a national problem caused mainly by the chlor-alkali industry. There are 14 chlor-alkali plants in Canada using mercury cells to produce chlorine and caustic soda. Their combined capacity is approximately 1,550 tons of chlorine per day. It has been estimated that in 1969 the Canadian chlor-alkali industry consumed approximately 39 pounds of mercury per 100 tons of chlorine produced. This 39 pounds represents losses to air, water (an estimate of 20 pounds into water) and land as well as quantities of mercury discharged with the products. Subsequent pollution abatement programs resulted in reducing losses of mercury to the water to less than one pound per 100 tons of chlorine produced. Proposed federal regulations would limit mercury losses by chlor-alkali plants to 0.5 pounds per 100 tons. Many chlor-alkali plants are already doing better. To comply with these regulations all chlor-alkali plants will be required to submit to the Canadian government a regular accounting of mercury used. Anticipating tighter environmental constraints, the largest chlor-alkali plant in Canada is abandoning the mercury cell process in favour of a non-mercury diaphragm process.

Other significant sources of mercury contamination in Canada include burning of coal and oil, waste-water

effluents from mining activities, and disposal of manufactured products containing mercury. Programs are currently being developed to control and abate mercury losses from these sources.

It is the unexpected conversion of the metallic mercury in bottom sediments to the highly toxic and persistent methylated form which creates such a serious problem. Despite the Japanese experience at Minamata and Niigata, the methylation process was not recognized until 1968.

Canadian researchers are currently investigating the fate of mercury in sediments, sublethal effects on fish, the forms of mercury in fish and in the general environment, and are carrying on a continuing review of the methodology for mercury analyses.

3.9 DDT, the PCB's, etc.

Research in the late 1960's showed that DDT residues had spread throughout the country, even to isolated, unsettled areas. Much of this research focused on birds, and it was found that the elimination of some bird populations over large areas of their range had been caused by DDT residues. Also of great concern were the effects on humans of long-term exposure to small quantities of DDT. For these reasons, in November 1969, the Prime Minister announced a policy of phasing out DDT uses as soon as safe replacements could be found.

This has reduced DDT uses in Canada to a fraction of the use during the previous two decades. Where other chlorinated hydrocarbon pesticides have been shown to do damage to wildlife, their uses have also been reduced.

Research on agricultural chemicals revealed that chemically similar industrial chlorinated hydrocarbons, the PCB's, were also widely spread in the biosphere. The Canadian data match

those from North America and northern Europe. The reaction of industry to the PCB discovery has been instructively different from its reaction to DDT. Twenty years of research and documentation of environmental damage in North America and Europe was necessary before the uses of DDT were reduced, and this in the face of strong opposition. After only a few years of research into PCB's that was only the beginning of a lengthy job, the industry in North America has voluntarily cut back the uses most likely to cause trouble. Such a responsible step by industry, acting in close co-operation with government, is an example of how environmental problems can be tackled.

3.10 Motor Vehicle Emission Standards

Federal standards regulating exhaust emissions from new motor vehicles manufactured in or imported into Canada are issued and enforced under the Motor Vehicle Safety Act, administered by the Ministry of Transport. They require compliance on a uniform national basis.

Initial control of emissions is accomplished by federal requirements for emission control devices at the manufacturing stage and is followed by provincial requirements for the continuing use of such devices on registered vehicles. Emission standards, developed by Environment Canada in co-operation with the Ministry of Transport, were first enforced on the 1971 model year. Standards will become more stringent for the 1975 and 1976 models.

Canadian standards are similar to those of the United States, not only because of proximity and the resultant flow of vehicles across the border, but also because we tend to have similar pollution problems.

This super-highway carries traffic through Metropolitan Toronto, which has one of the highest numbers of motor vehicles per capita in the world.

Cette grand-route assure la circulation à l'intérieur de Métro Toronto qui compte le plus grand nombre d'automobiles par personne au monde.



3.11 Radioactive Cesium in the Canadian North

Radioactive cesium (Cs-137) is one of the long-lived by-products of nuclear weapons testing. It and other components of radioactive fallout have been widely distributed over the Northern Hemisphere, and in particular in the 30°-60° latitude band.

Because of its chemical properties, Cs-137 is readily incorporated into vegetation. In the North, it became involved in a special food chain relationship: lichens — caribou — man.

Special studies of this problem in Canada were initiated in 1963 by the Department of National Health and Welfare. Initial measurements indicated Cs-137 levels as high as 35 microcuries per pound of fresh caribou meat. Regular samplings of human urine were made at about 25 northern communities and average values reached peak levels of about 4 microcuries per litre in the period 1964-67.

Additions of Cs-137 to the stratosphere reservoir have been minor since the Test Ban Treaty was signed in 1963 and observed levels have been gradually declining. Such international agreements to control the release of radioactive materials to the atmosphere are regarded by Canada as being both necessary and effective.

From 1965 to 1969, annual surveys of Eskimo communities were made to determine human body contents of Cs-137 using a portable "whole body counter". The levels were from 20-100 times those in southern inhabitants. The highest individual body-burden values exceeded 4 microcuries. This should be compared with a level of 3 microcuries which, if sustained, would result in a radiation dose equal to the limits for individuals recommended by the International Commission on Radiological Protection. Because of seasonal

variations in dietary habits, the relatively rapid elimination of Cs-137 from the human body, and the safety factors inherent in developing protection standards, it is most unlikely that these values could ever be associated with observable clinical effects in exposed individuals. Meanwhile, the alerting networks involving air and precipitation sampling are being maintained.

3.12 Industry-Government Co-operation

Many industries are voluntarily co-operating with senior levels of government to reduce environmental degradation. For example, discussions have been under way for a number of months between representatives of the Canadian petroleum industry and the federal and provincial environmental protection agencies to determine the state of the art of water effluent treatment for the industry. In addition, the technical aspects of possible effluent control standards are being investigated.

Development of environmental protection regulations through an industry-government task force has been successfully carried out in Canada with the pulp and paper industry. The petroleum industry has indicated its willingness to co-operate in developing practical and effective effluent limits.

Industry and government are jointly developing over 150 regional oil spill response/action plans throughout Canada. These will be basic components of the national contingency plan for the control of spills of oil and toxic substances (see section 7.6). These joint programs have made it possible to combine the technical expertise of the industry with the logistic support of government agencies into effective task forces ready to begin clean-up as soon as a spill occurs. The application of "situation simulator training" to the

potential environmental hazards of oil spills makes it possible to respond quickly to almost any spill situation.

This voluntary approach to preparing for potential hazards can provide complete coverage. Control by regulation can provide only for recognized hazards and is not predicated upon the principle that environmental responsibility must be assumed by all parties concerned.

3.13 Migratory Birds

The last passenger pigeon died in 1914. The extinction of a species which once numbered in the millions gave impetus to the Migratory Birds Convention of 1916, an international agreement between Canada and the United States. Since then, no species of bird migrating between Canada and the United States has become extinct.

The Convention recognizes that migratory birds are an international resource of great cultural and economic value and that their protection and management require international co-operation. The governments of Canada and the United States and of the provinces and states have jointly developed active conservation programs. Co-operative research and management activities in both countries are co-ordinated by informal committees and consultations. Twice each year Canadian and United States federal, provincial and state agencies conduct co-operative surveys of the portion of the continent that produces 80 per cent of the waterfowl. Population guidelines have been established and the harvest is regulated to maintain those populations.

Within Canada, federal-provincial technical committees develop and co-ordinate co-operative studies. Harvest regulations are set annually at a national federal-provincial wildlife con-

Industry is co-operating with government in protecting the ecology of Sable Island, in the Atlantic Ocean, 90 miles off the Nova Scotia coast, and site of an oil and gas exploration program.

L'industrie collabore avec le gouvernement pour protéger l'écologie de l'Île-de-Sable, dans l'océan Atlantique, à 90 milles au large de la Nouvelle-Ecosse et qui fait l'objet d'un programme d'exploration pour trouver du pétrole et du gaz.

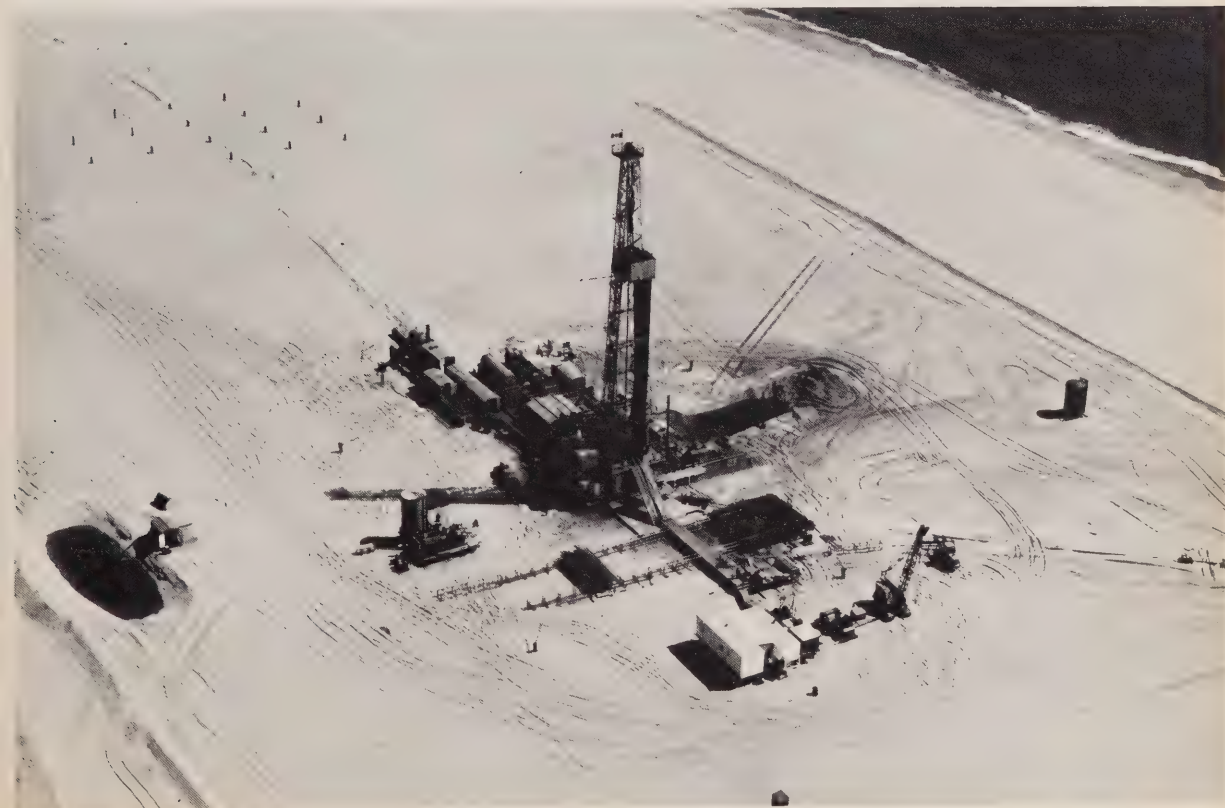
ference. The approach is thus an integrated one, involving two levels of government as well as representatives of sportsmen's and naturalists' organizations.

Migratory bird management necessarily includes management of their habitat. Vital wetlands have been preserved and improved. Private landowners are encouraged to maintain habitat for waterfowl. The Canadian government also preserves important breeding grounds through establishment of migratory bird sanctuaries which cover some 30 million acres.

Over the past 30 years the numbers of most species of migratory birds have stabilized. In fact, some species, such as some of the geese, are more numerous today than when Canada was first settled.

Canadians support these programs, recognizing that without its migratory birds their environment would be an impoverished one. Canadian concern extends to the 100 million ducks and 10 million geese which summer in Canada, to the 59 whooping cranes that breed in Wood Buffalo National Park and the 3,000 Ipswich sparrows

of Sable Island. It is important to Canadians that not only the numbers but also the diversity of birds be maintained.



Increasing pollution of Lake Ontario, one of the Great Lakes, is of concern to both Canada and the United States.

La pollution croissante du lac Ontario, l'un des Grands lacs, est un sujet de préoccupation pour le Canada et les Etats-Unis.



4 The Regional Response

Canada and the United States are carrying out an extensive scientific study of the Great Lakes, the world's largest supply of fresh water.

Le Canada et les États-Unis poursuivent une étude scientifique approfondie des Grands lacs, la plus importante réserve d'eau douce au monde.

4.1 Planning on a Grand Scale

Effective machinery for management of the environment and control of pollution is bound to be complex. Recognizing the complexity of ecosystems, singly and in combination, such machinery must provide for interdisciplinary studies and integrated action. Because man-made boundaries may cut across natural systems, co-operation between governments is often mandatory.

In Canada, co-ordinated or joint federal-provincial or international programs provide a desirable approach to environmental management. Some examples are: the pilot project on river basin planning in the Saint John River Basin; federal-provincial studies of social and environmental effects of the James Bay hydro-electric project undertaken prior to the beginning of project design; the Canada/Manitoba Churchill and Nelson Rivers and Lake Winnipeg study; and the Agreement between Canada and the United States on Great Lakes Water Quality.

4.2 The Canada-United States Agreement on Great Lakes Water Quality

This Agreement, signed by Prime Minister Trudeau and President Nixon in April 1972, is a new kind of international accord. It is directed at the protection of the largest body of fresh water in the world, a priceless natural resource in the heartland of North America shared by Canada and the United States. Under its terms, the two countries agree to reduce present levels of pollution in the Great Lakes and in the international section of the St. Lawrence River, and to protect these vital waterways against future pollution.

Pollution in the Great Lakes has contaminated the open and inshore waters in many areas, affecting water



supplies, damaging shore properties, closing many beaches, and killing fish. In many places, pollution crosses the international boundary, damaging water quality on the other side. One of the most critical pollution problems in the lower lakes area is eutrophication. Lake Erie, and to a lesser extent Lake Ontario, have become over-enriched by phosphorus and other nutrients which cause an excessive growth of vegetation in the water. Massive blooms of algae cover large areas of Lake Erie in the summer. Washed ashore, they foul beaches and water intakes; decayed, they rob the bottom waters of precious oxygen. Over 2,000 square miles in Lake Erie alone are affected. Unless effective measures are taken over the next few years, the lakes will reach an advanced state of eutrophication from which it would be difficult for them to recover.

In 1964 the governments of Canada and the United States asked the International Joint Commission (IJC) to make a complete study of pollution problems in Lake Erie, Lake Ontario, and the international section of the St. Lawrence River, and to recommend measures to restore and protect the quality of these waters. IJC was created by the Boundary Waters Treaty of 1909, and has helped the two countries settle many problems along their common boundary. High on IJC's agenda in recent years have been environmental problems, especially Great Lakes pollution.

The IJC engaged scientists and experts from both countries to carry out one of the most intensive studies ever made of pollution problems in lakes. In late 1970 it submitted its findings and recommendations. The Commission's analysis and recommendations provided a sound basis for the negotiation of an agreement between

the two countries to restore and protect the entire Great Lakes system.

Direct discussions between Ottawa and Washington were opened in the spring of 1970 on ways to implement the recommendations expected from the IJC later that year. The governments of Ontario, Quebec, and the Great Lakes states were all involved in the following two years of negotiations. Under the Agreement, the two countries have agreed on a challenging set of common water quality objectives — goals that can be achieved given accelerated efforts on both sides. To reach their objectives the Agreement commits both countries to implement programs and other measures that are to be completed or well under way by 1975.

The programs called for under the Agreement include:

- Completion or near completion by the end of 1975 of all municipalities' waste treatment facilities, including phosphorus removal, designed to meet the new water quality objectives
- Reduction of tonnage of phosphorus discharged into Lake Erie and Lake Ontario to levels that will permit the natural restoration of oxygen-deficient waters by 1975
- Construction and operation of waste treatment facilities by industries around the Great Lakes which will be consistent with the agreed objectives
- Maintenance of a joint contingency plan
- Maintenance and extension of regulations concerning the discharge of wastes from shipping and on-shore facilities
- Improved management of dredging operations, to reduce pollution effects.

In addition, the International Joint Commission is making arrangements for two more major studies:

— A study of pollution in Lake Huron and Lake Superior with recommendations on measures needed to prevent pollution in these lakes

— A study of ways to reduce water pollution from land drainage, forestry and agricultural sources, with recommendations for programs and measures to reduce pollution from these sources.

On the Canadian side funds necessary for the accelerated anti-pollution programs are being provided under an agreement signed in August 1971 between the federal government and the Government of Ontario. Loans totalling \$167 million will be provided by the federal government over the five-year period 1971-75, for a construction program costing a total of \$250 million. One-quarter of the total amount of these loans is forgivable once the work is completed. The Government of Ontario will make substantial contributions to the improvement of municipal sewage treatment facilities, while municipalities will be responsible for local sewers and ancillary facilities.

To ensure that these funds are effectively utilized, a Joint Review Board supervises a \$6 million program set up under this Agreement for determining the most suitable kinds of waste treatment at each city and for the conduct of research studies on such treatment.

The IJC will supervise the implementation of the international agreement and monitor the success of the abatement programs. It will make regular reports to the governments and to the public and may recommend new programs. The Commission is expected to set up a regional office in the Great Lakes area to carry out its many new tasks and studies.

The Agreement is not a stand-still

The Mactaquac dam and reservoir provides multiple uses of the water resource of the Saint John River, New Brunswick.

Le barrage et le réservoir Mactaquac permettent l'utilisation de l'eau sur la rivière Saint-Jean, au Nouveau-Brunswick, à des fins multiples.

arrangement. It is designed to be changed without difficulty whenever needed to meet new problems or when new scientific findings or technology show that there are better ways of controlling Great Lakes pollution. It is expected to bring about an early improvement in the quality of water in those areas of the Great Lakes now suffering from water pollution, and will offer greater protection for the future.

4.3 The Saint John River Basin Agreement

The Saint John River basin in the Province of New Brunswick is the setting for a new approach to water resource management. The river rises in the neighbouring Province of Quebec and the State of Maine, and flows 420 miles through New Brunswick to the sea. From the early beginnings of Canadian settlement the river has dominated the economy of the region. The river basin is relatively well endowed with natural resources, but the region itself is comparatively poor. Economic activity is based on pulp and paper production, farming and food processing. All are major contributors to the pollution that limits the use of the river system for other purposes.

Waste disposal and generation of power are the major uses of the river system. The headponds behind power dams reduce the natural ability of the River to cleanse itself of the waste discharged into it. The survival of aquatic life, including the once-flourishing salmon, is threatened by the poor quality of the water. The basin has other problems: damaging floods, erosion of farmlands, siltation and water contamination from pesticides used in agriculture and forestry.

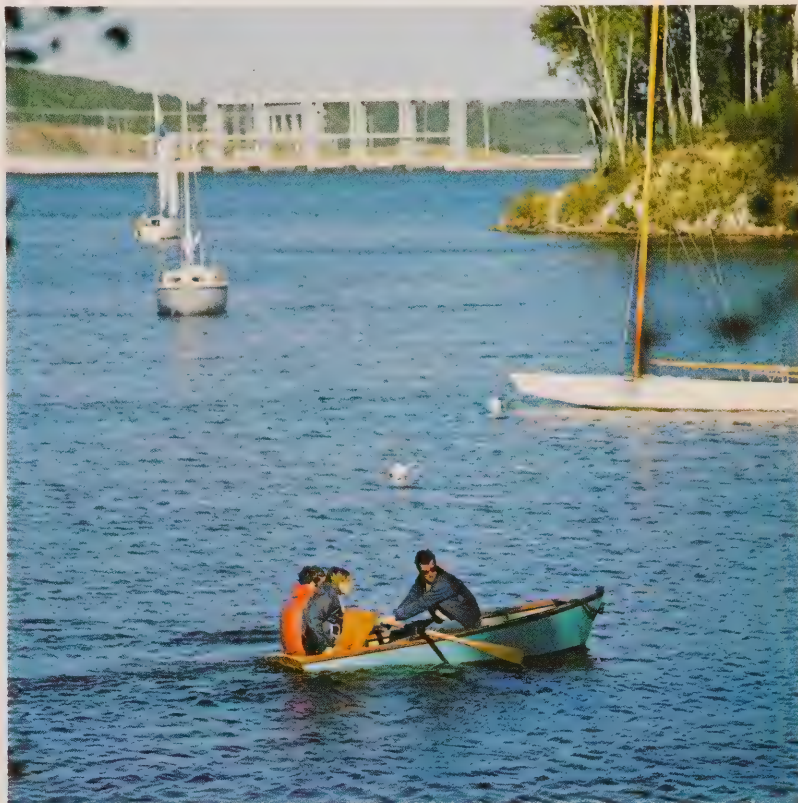
The Saint John River basin lies within Canada and the United States. Each has a federal system of govern-

ment, so five governments—Canada and the United States, the State of Maine and the provinces of New Brunswick and Quebec—have jurisdiction over different aspects of river basin management.

The Canada Water Act (1970) offers new approaches to the problems of a river system such as the Saint John. Under the Act, water management is formally recognized as a “comprehensive” activity, requiring integrated planning for all water uses in a river basin. The Act provides the framework for establishing intergovernmental

river basin authorities to prepare and, with the approval of the governments concerned, implement comprehensive plans for water-course development and water quality control.

In 1970, the federal and provincial governments signed the Canada-New Brunswick-Saint John River Basin Agreement. The federal government pays over a three-year period, 90 per cent of the \$775,000 allocated for development of a comprehensive management plan. A joint federal-provincial planning group—a six man board, an advisory committee and a



planning office – was appointed. The board consists of three federal and three provincial appointees. The advisory committee is representative of all the technical skills and functions required for comprehensive water resource planning and management, as well as municipalities, industries and conservation groups. The planning office co-ordinates a large number of tasks undertaken by departments of both governments, according to jurisdiction. In co-operation with the planning office, a small professional team works with the residents of the basin in developing the plan.

Participation by the public is considered an essential part of the planning process. Under the terms of the agreement, the board first prepared an interim water quality management plan, based on knowledge of major pollution sources, and suggesting schedules and amounts of waste abatement. As the program proceeds, the plan is enforced by the two governments.

The Saint John River program presents a number of innovative and unique features. Sophisticated management techniques will be tested, including mathematical models for simulating and predicting the effects of proposed developments on water quality and quantity. A critical path method is being used to control and integrate the various components of the planning project.

The international character of the basin requires that Canadian and United States management programs be integrated, and meetings of planners from both sides of the border have been held. The Saint John program has also attracted the attention of other countries. A committee of NATO members will observe the methods used and results achieved as an example of comprehensive water resource plan-

ning in an international setting.

The Saint John River agreement represents one approach Canadians are taking to environmental problems within their complex inter-jurisdictional setting. The main challenge within the agreement is to make water resource planning compatible with planning for general economic development within the Saint John River basin. This will call for many hard decisions if economic growth and environmental quality are to be harmonized in New Brunswick.

4.4 Environmental Planning for the Prairies

Manitoba, Saskatchewan and Alberta are often referred to as the "Prairie Provinces". The absence of extensive geological folding and faulting accounts for great areas of level and gently rolling lands. Capped with rich dark soils and great sweeps of open grassland, they are one of the world's major agricultural regions. It was these lands which attracted most western settlement.

But the prairie grasslands cover less than half of the three provinces. In each, vast northern regions stretching well into the sub-Arctic, are virtual storehouses of both renewable and non-renewable resources. These areas are now being subjected to extensive exploration and increasing development.

Many regard these northern lands primarily as a source of raw material. Indeed, development of mining, pulp and paper, and hydro-electric industries is spreading. Another view is that the economic and environmental importance of recreation and tourism is increasing and must be incorporated into the equation of developmental benefits and costs. Resource development has had significant impacts on the

environment: river flows have been changed, wildlife habitat lost, and the threat of pollution has emerged. All this has changed the way southern Canadians have perceived their middle north, and these regions are receiving greater attention than ever before from the governments concerned.

Settlement remains densest in the southern regions and along the rivers. Nowhere in Canada is there a greater contrast between urban population densities. Between them the five major cities of the three provinces contain approximately 47 per cent of the total population of 3,550,000. The remainder of the population is largely distributed among many much smaller communities or on isolated farmsteads and ranches across the 880-mile breadth of the southern prairies. Small numbers live in the northern areas, where some of the inhabitants are brought together in well-planned modern communities associated with specific resource development sites, while others dwell in isolated communities with few social and economic resources.

To overcome this socio-economic disparity, the Province of Manitoba has been co-operating with the federal government since 1967. A major program in the Interlake region – between Lakes Winnipeg, Manitoba and Winnipegosis – is designed to increase levels of income and standards of living of 50,000 people in an area of over 10,000 square miles. Education, retraining, renewable resource development and administration, key elements in the program, call for a total investment of \$85 million by 1977.

4.4.1 *The Northern Accommodation*

Development of the North poses important questions. How can resources be best developed without undue disturbance of the environment

Many northern Canadian Indians prefer the traditional ways of living off the land.

Plusieurs Indiens du Nord canadien préfèrent leur mode de vie traditionnel et vivent à même l'environnement.



A new generation of Eskimo people is learning new skills at government-operated training schools.

Une nouvelle génération d'Esquimaux apprend de nouvelles techniques dans les centres de formation du gouvernement.

and the way of life of northern people? Until recently, the development of isolated mines and the harvest of wild-life by northern residents, most of them Indians, were almost the only natural resources exploited in the North. But moves to develop further the power, mineral, forest and recreation potentials of these areas could give rise to substantial changes in the environment and could directly affect the Indian people and their way of life.

The introduction of the "white man's" way of life by developers who bring with them their material comforts

— communities complete with houses, shopping centres, and theatres, automobiles, aircraft — has caused a social upheaval in the North. The native people are questioning the right of developers to move on to what they believe is their land. They see skilled workers brought into the region to jobs that the native people are unable to do because of lack of training or difficulty in adaptation. They see few benefits from economic growth.

How do governments and society hope to achieve the needed accommodation? Governments are placing their

hopes on education and technical training to prepare the native people for a place in the "New North". They are providing residents with many amenities — houses, hospitals, schools, recreation facilities, communication and transportation facilities. At the same time, developers sharing the privilege of participating in northern development and its rewards, are expected to provide jobs and on-the-job training for northerners. Northern residents taking advantage of the educational and technical training programs apparently endorse the approach as the best means to participate in and benefit from economic growth.

Governments feel that the North should be developed in such a way that the native people can reasonably choose between joining industrialized society or retaining their traditional life style. But the choice between the traditional way of life and the new, with all its problems, is a difficult one for many northerners.

4.4.2 *The Southern Accommodation*

In the wheat-producing areas of the southern prairies governments have had to deal with other problems. The development of the agricultural industry has brought about a major ecological change. Vast expanses of grassland have been brought almost entirely under cultivation. The cultivation of semi-arid areas in the extreme south caused major problems of soil erosion, especially in the 1930's. Agencies of the federal and provincial governments — aided by university, conservation, farmer and other groups — have since been successful in developing and applying conservation methods to farming in these areas.

Lately there has been emigration from the wheatlands, partly because



Many Saskatchewan communities are dying as residents leave to search for better opportunities in the cities.

Plusieurs communautés de la Saskatchewan disparaissent à mesure que leurs habitants partent à la recherche de meilleures occasions dans les villes.



mechanization has resulted in fewer but bigger farms and has reduced the need for agricultural labour. Opportunities offered in the cities seem more attractive, especially to youth. Many prairie farms have been served by towns of a few hundred people, built around railway grain elevators. The number of railway lines on the wheatlands is being reduced, as trucking of grain becomes more efficient, and these small elevator towns are declining rapidly. If the farm and small town population continues to decline, it will become increasingly difficult to provide it with a full range of up-to-date community services.

What is to happen to the surplus farm population and the residents of these elevator towns? Many have spent their entire lives in one community and a move to another location, particularly to a city where their life style would be completely changed, could be disruptive. Their income, sufficient in a rural setting, may be inadequate in an urban environment. The arrival of poor people in a city inevitably places new demands on local governments, already faced with rising welfare costs.

There are indications in the southern prairies that some residents of small elevator towns are moving into middle-sized regional service centres, where further development of secondary industry may occur. This is an interesting modification of the movement to the larger urban areas.

4.4.3 *Water for the Prairies*

The location of the Canadian prairies in the interior of a large continent does not allow a great range of climate conditions. The north-south alignment of the Rocky Mountains, inland from the Pacific coast, effectively shields the interior against heavy rainfall. There are, however, some significant climatic variations. Southern

Alberta is one of the driest areas of Canada; the average annual rainfall is 13 inches. Further north and east, precipitation varies from 14 to 20 inches per year, with southern Manitoba averaging a little over 20 inches. This sparse rainfall is a critical factor for farmers of the plains, for it directly affects total water supply.

The need for domestic and industrial water has steadily increased with urban population growth, industrial and commercial development and changing agricultural practices. Constant flows in the major river systems are needed to maintain proper dilution of sewage and industrial wastes, particularly in the southern prairies. In the north, the water is used mainly for hydro-electric generation, pulp and paper production, and recreational purposes.

The prairies are served by a number of great river systems. Rising in the Rockies and flowing east to Lake Winnipeg and north to Hudson Bay, the Saskatchewan-Nelson drains over a half million square miles — most of the settled southern and part of the north-eastern prairies. The Churchill and Peace-Athabasca systems cover most of the sub-arctic area and the Prairie Provinces; the former drains into Hudson Bay, the latter into Lake Athabasca and thence to the Arctic Ocean via the Mackenzie.

The quality and quantity of these waters are of major importance. The three provincial governments and the federal government have entered into an agreement which provides for the apportionment of interprovincial waters flowing east. The upstream province may make a net depletion of one-half of the natural flow occurring within its boundaries. Each province is thus assured of a fixed proportion of water, and need not accelerate development

in order to reserve a reasonable share. The Prairie Provinces Water Board ensures that the terms of the agreement are met and monitors water quality. This agreement is a milestone in Canadian water resource development in that it recognizes the respective rights of provinces to a common resource and the interdependence of their people.

The high priority that the Prairie Provinces attach to water is exemplified by the Saskatchewan Water Resources Commission. Formed in 1964, the commission has the responsibility of regulating, planning and co-ordinating the use of all water in the province. It has broad legislative powers respecting planning, co-ordination, pollution, water rights and hydro-electric projects.

Over 60 per cent of North America's most sought after waterfowl breed on the prairies. The continuing drainage of marshes, potholes and other wet lands in the rich grain-producing areas has a direct effect on their habitat (see section 3.13). The Government of Saskatchewan recently established a citizens' committee to provide advice and help resolve the conflict between agricultural and wildlife interests.

The value of water to this region is both tangible and intangible. As public perceptions increasingly reflect concern for improving the quality of environment, it behooves all levels of government in the prairies to be good stewards of this precious resource. The prairie governments, moving forward in many areas of environmental control, consider water management of paramount importance in preserving the quality of prairie life.

4.4.4. *Environmental Protection and the Natural Gas Industry*

Alberta may soon become the world's largest producer of sulphur from any source. It is already the world's

largest producer of the high purity elemental sulphur recovered from sour natural gas. This position, attained in little over 10 years, is the result of the need to desulphurize natural gas before delivery to market. In 1960, Canada was still a net importer of sulphur, having a productive capacity of only 274,000 tons per year. In 1972, it is predicted that Alberta's sulphur production will be 7,000,000 tons.

This remarkable rate of growth in one decade is a major achievement and was effected by pioneering in the technology of producing, gathering and treating sour natural gas. Sour gas, with hydrogen sulphide concentrations ranging to 50 per cent, is now being discovered in ever-increasing quantities. Major changes are taking place in processing plants to achieve maximum recovery of sulphur and reduce emission of sulphur oxides to meet air pollution control requirements.

Bearing in mind its responsibilities for pollution control and the impact on the environment of sulphur dioxide emissions, the Alberta Government has developed, in concert with the natural gas and petroleum industry, stringent guidelines for sulphur recovery efficiency. These are related to plant size and various acid gas qualities.

Alberta's Energy Resources Conservation Board and the natural gas and petroleum industry have made significant contributions to flare design and operation to overcome the intermittent but, sometimes, sizeable sulphur dioxide emissions which can result from failures in the processing units. The industry has shown innovative skills in recovering the small but widely distributed sulphur dioxide emissions, which result from the flaring of marginal to non-economic quantities of sour gas associated with crude oil.

4.5 A Marine Reserve in the Strait of Georgia

A new concept being discussed on Canada's west coast is that of a marine reserve situated in the unique waters of the inland sea between Vancouver Island and the mainland of British Columbia. The physical surroundings are varied and impressive. The Fraser River estuary is large and carries a heavy load of nutrients to the sea. North of the Fraser, deep narrow fiords separate mountain ridges a mile or more in height. At some places, glaciers reach down towards the inland sea; at others, local rainshadows support vegetation communities of near mediterranean type.

Wildfowl and sea-birds abound. Forestry is a major industry and the commercial fishery provides employment for thousands. Free swimming creatures from herring to killer whale, from crab to octopus, are found there. It is little wonder that the people of western Canada have great concern for preservation of the living resources of the area.

Designation of this inland sea as a "water quality management area" would be a great accomplishment. The world's finest salmon runs would be preserved. Extensive oyster beds would be protected.

A federal-provincial task force has been set up to identify those parts of the Strait of Georgia which should be classified as "wilderness"; those which should have limited accessibility; and those which should be regarded as buffer zones between the main body of water and centres of population and industry.

It is hoped that the initiative taken on the Canadian side of the international boundary will be mirrored by similar regulations and action in the United States. The park-like surroundings in

the Puget Sound area of the State of Washington could also be preserved in this way.

4.6 Canada's Arctic and Sub-Arctic

The developing Arctic and sub-Arctic provide opportunities and pose problems similar to those of the northern portion of the Prairie Provinces.

The 1.5 million square miles lying north of the provinces and comprising the Yukon and Northwest Territories are relatively untouched by man, despite a tremendous increase in activity.

Extensive exploration programs for oil, gas and minerals, several new producing mines, and the expansion of facilities for land, marine and air transportation have brought changes in the economy and social fabric of the North. There is every indication that such activity and change will increase. Recent discoveries of oil and natural gas in the Mackenzie Delta and the Arctic Islands suggest that a major industry may be developed there. Considerable effort is being expended by government and industry to determine optimum methods of extraction and the best routes and methods for bringing these resources to the markets of Canada and the world.

In Canada's North, Indians, Eskimos and Metis form a majority of the northern population. They live in widely separated communities and to a significant degree continue to live, in a traditional way, off the land. Those native people, whose livelihood depends wholly or in part upon hunting, trapping and fishing, have expressed concern over the adverse effects that this increased activity could have upon their traditional way of life. Indians and Eskimos have reacted vigorously against despoilation of the natural environment, but they know that jobs and other opportunities can flow from development.

The well at Drake Point, Melville Island was one of the first to be drilled in the Arctic Archipelago.

Le puits de Drake Point, sur l'île Melville a été l'un des premiers à être foré dans l'Archipel Arctique.



(left) A test facility at Sans Sault, Northwest Territories, is providing valuable information on northern pipeline construction and operation for the oil and gas industry.

(right) Drilling crews face sub-zero temperatures and chilling winds in the search for oil and gas in the Arctic.

(gauche) Une installation à Sans Sault, dans les Territoires du Nord-ouest, permet de faire des expériences et d'obtenir des renseignements précieux sur la construction d'oléoducs et de gazoducs dans le Nord.

(droite) Les équipes de travail doivent faire face à des températures très froides et à un vent glacial dans leur chasse au pétrole et au gaz de l'Arctique.

The arctic environment already bears evidence of man's destructive capability. Because of the low regenerative capacity of tundra vegetation, vehicle tracks may remain for decades and, where the insulating mat is broken, small ruts may expand into major gullies or lakes that disrupt the drainage. Sub-arctic forests have extensive reserves of usable wood, but regeneration is so slow they cannot be reharvested for perhaps two centuries.

The possibility of oil spills – from wells, pipelines or tankers, on land or off-shore – is a threat to the environ-

ment. The increased activities, the traffic, the mere presence of additional people pose a direct threat to wildlife. Decimation of the significant proportion of North America's migratory birds that nest in the Canadian Arctic, and of the many species of wildlife unique to the North, would leave the entire continent so much the poorer from the loss of an irreplaceable resource. An oil spill or disturbance of sediments along the shore would almost certainly have more severe consequences, for both marine and terrestrial life in the Arctic, than in temperate regions.

The Canadian government's three top priorities for the next decade in the North are placed in the following order:

(a) To give a rapid effect to certain agreed guidelines for social improvement, particularly in respect of native peoples.

(b) To maintain and enhance the natural environment through such means as intensifying ecological research, establishing national parks and ensuring wildlife conservation.



(c) To encourage and stimulate the development of renewable resources, light industries and tourism, particularly those which create job and economic opportunities for native northerners.

These priorities do not overlook the fact that the world demand for non-renewable resources is growing rapidly. In any realistic assessment, the economic future of the North and its contribution to the Canadian economy as a whole lie in the carefully planned development of the substantial, non-renewable resource potential.

In this connection, the federal and territorial governments, industry and the scientific community have joined in an examination of the environmental, ecological, social, economic and engineering problems associated with the building of oil and natural gas pipelines in northern conditions. Engineering designs will be based on the best environmental, engineering and economic knowledge and advice available. Construction will be controlled to minimize the detrimental effects and enhance the beneficial ones. Operating techniques are being similarly planned. Technical training programs are under way to prepare the northern residents for their place in this new environment; and plans are being formulated to control future community development to the best advantage of the residents.

Again, when a developer wanted to create an artificial island from which to drill exploratory wells, in the shallows off the Mackenzie Delta, governments joined with industry and the scientific community to plan an approach to the project. The project will measure environmental protection, engineering, economic and social needs against existing knowledge. It will be used as the basis for continuing study to enhance our meagre understanding of the vari-

ous impacts of this type of activity.

In November 1971, Northern Land Use Regulations were promulgated under an amendment to the Territorial Lands Act. These Regulations provide for the control of any land use operations carried out north of the sixtieth parallel. In areas where environmental conditions are particularly sensitive to change, land management zones have been declared. Within these zones, no land use operation may be conducted without a land use permit. Provision is also made for payment of a security deposit before operations begin.

Companion to the Land Use Regulations is the Northern Inland Waters Act, proclaimed in 1972. This Act ensures federal control and management of all fresh water in the Yukon and Northwest Territories. Any industrial or commercial user of water must apply for, and receive, a water-rights licence before commencing operations. The Act provides for a water board for each territory. Each board has the right to call public hearings, to request environmental impact studies of any applicant and, finally, to submit recommendations to the government with respect to any application.

As land use regulations were being developed it became apparent that few data were available on the effects of man-made disturbance to northern lands. To fill the gaps the Department of Indian Affairs and Northern Development established the Arctic Land Use Research (ALUR) program with which is associated an advisory committee of university scientists and industrial representatives. ALUR's objectives are to provide an information base for regional planning and for the management of northern resource development.

To ensure that research is directed toward agreed policy objectives, an interdepartmental subcommittee of

federal government scientists, working under the auspices of the Advisory Committee on Northern Development, is developing guidelines for science in the North.

In spite of heavy pressures, from outside and within Canada, to get resources out rapidly, the delicately balanced ecological system must be maintained and the government's support for major development projects, whether public or private, must be based on a full assessment of their social, environmental and economic impact, both in the northern territories and in Canada generally.

4.7 Parks and Historic Resources for Posterity

Canada has outstanding systems of national and provincial parks, covering many terrestrial and aquatic ecosystems as well as geologic and historic sites. There are 28 national parks and one reserve in a system that stretches from the Pacific to the Atlantic, from the Great Lakes to Davis Strait in the Arctic. It is the federal government's goal to have all of Canada's natural regions adequately represented within the system.

National parks in Canada are relatively large, publicly owned, natural environments, set aside for the benefit, education and enjoyment of people. Commercial exploitation of natural resources is discouraged. Preservation of the natural environment, while allowing for public use, is the biggest challenge facing the managers of national parks. Uncontrolled use by visitors can destroy the natural features for which the parks were established. To provide for the benefit, education and enjoyment of people and the preservation of natural environments, the park administration operates planning,

Forillon National Park, in the Gaspé region, the first national park in Quebec.

Le parc national Forillon, dans la région de Gaspé, est le premier parc national aménagé au Québec.



natural resource conservation, interpretation and visitor services programs.

The planning program produces master plans, which include land use zoning, for each park. Public hearings are held to consider each park master plan. These master plans then form the basis of park development and management which assure protection of important natural features yet permit maximum use by visitors.

There are 1,814 provincial parks in Canada, covering 249,000 square kilometres (96,000 square miles), and more are being created continually. Although the objectives and land use of provincial parks vary within and between provinces, the principal aim is to preserve land for recreation. Some sites are being preserved for scientific purposes and this kind of preservation is on the increase. Many provincial governments recognize the need for maintaining natural areas, and wilderness areas of considerable extent have been established.

Most provinces have some system of classifying parks which recognizes different uses of the resources they contain. One difference between national and provincial parks is with respect to forestry. The former do not allow commercial logging; while in some of the latter it is permitted provided that certain prescriptions are followed.

Unlike the natural resources that are preserved as national or provincial parks, historic resources are scarce, unique, non-renewable, tangible remains of man's activity. They range from the archaeological evidence of the peopling of the New World to examples of 20th century architecture and technology; from archaeological and ethnographic specimens, through documents, objets d'art and antiques to buildings and large parcels of land.

Majestic mountains and glaciers are characteristic of the new Kluane National Park, Yukon Territory.

Les montagnes et les glaciers majestueux constituent l'un des attraits du nouveau parc national Kluane, dans le Territoire du Yukon.



The thread common to all these remains is that they illustrate man's past for the benefit of the present in facing the future. They are easily destroyed, all too often threatened and, once gone, can never be replaced.

The federal government has been active in the national historic resources field for more than fifty years. The system of National Historic Parks and Sites has developed from one Nova Scotia site in 1917, to approximately 95 parks and major sites, in various stages of development, located throughout the length and breadth of the nation today. The National Parks and the Historic Sites and Monuments Acts are the legislative tools used in the implementation of the program. The recently announced plan to introduce legislation to establish a form of national trust in Canada, to be known as Heritage Canada, is designed to effectively complement the existing federal program.

The Canadian Inventory of Historic Buildings is a good example of the kind, quality and quantity of research underway to ensure national commemoration of historic objects. This unique survey of Canada's old buildings was launched in the summer of 1970, in two dozen cities from Dawson in the Yukon to St. John's, Newfoundland. It is believed to be the world's first comprehensive architectural survey created for a computerized information system. Architects throughout the world have shown much interest in it. The project will take 10 years to complete beginning with studies of exteriors of buildings and culminating with in-depth studies of the best structures. So far, 60 thousand buildings have been examined and about half of the records computerized and indexed.

Provincial programs designed exclusively to preserve and develop historic sites vary widely in scope and

authority, depending largely on provincial priorities and regional economic problems. Most provinces have programs under which sites of importance in provincial history are marked by plaques and monuments. Not all provinces have legislation to protect sites from vandalism or prejudicial transfers of ownership. Several have preservation and development programs designed to save the most important sites and historic structures and make them available to the public. The emphasis has been on the restoration of early buildings and the reconstruction of vanished features.

5 The Local Response

5.1 Where the Action Is

The battle against pollution must be fought, day by day, in the cities, in the towns and in the countryside. The troops are the people. Individually and collectively they can do a great deal to ensure that the health of the environment is not only protected but improved with the passage of time.

Individually, Canadians can do a great deal to reduce waste. Banding together in small groups, they can accomplish a lot on the local scene. Already, citizens' groups have initiated a number of legal actions concerning environmental degradation. Municipalities can pass by-laws and enforce them. Provinces have important powers to prevent the degradation of large areas within their jurisdiction, and the federal government can provide assistance and co-operation in many instances.

In Canada there are many private groups and organizations to which the concerned citizen can turn for advice and action. Using information supplied by the two senior levels of government and data and suggestions which they gather on their own, they have mounted clean-up campaigns, many of which are worthy of note. Fishermen, whose livelihood has been threatened by phosphorus and mercury, have banded together with a view to stopping industrial practices which have tended to undermine their livelihood. Eskimos and Indians have made their voices heard, especially in the North.

A growing body of expertise is being offered, voluntarily, by people employed in Canada's vocational institutes and universities. And management in Canadian industry is not only accepting the idea that environmental engineering is important, it is including environmental considerations as a major factor in its planning effort.

5.2 Citizens' Groups and their Objectives

Canada has approximately 500 citizens' community development and environmental groups organized to improve awareness of problems of human environmental quality and support the need for community and resource management. Comité de Citoyens, Move (Halifax), Pollution Probe, Society for Pollution and Environmental Control, Citizens' Committee of Winnipeg, Canadian Nature Federation, United Nations Association, Canadian Forestry Association are examples.

There are many types of organizations: those dedicated to the understanding and appreciation of nature, those organized to press for greater pollution control, and those advocating a more meaningful community development, to name a few. Much of their leadership comes from the academic community.

The traditional nature appreciation and conservation-oriented groups are experienced in national organization and co-operation to achieve their aims. However, the relatively new groups have yet to achieve co-ordinated national action. In many cases this follows from their singular community or regional outlook. With few exceptions, these organizations finance their operations from local fund-raising activities and from membership fees. The Canadian government, through a program of summer employment for youth provided \$880,000 for environmental projects in 1971.

Environment Canada recognizes the many benefits of citizens' organizations but, for the most part, does not financially support their activities. It believes that these groups should maintain their autonomy.

Many of these citizens' organizations advocate personal involvement:

becoming well-informed about environmental quality issues, determining the presence of local pollution problems and publicizing them, writing to politicians, organizing pick-ups of materials for recycling. Suggestions for personal involvement are available from the citizens' groups and from Environment Canada.

5.3 Garbage Disposal on a New Scale

Garbage collection and disposal has traditionally been a municipal or local operation, subject to supervision through provincial public health acts. Such supervision is related mainly to nuisance aspects and disease vector control. Most provinces now see solid waste management as a more complex activity. While disposal operations remain a local responsibility, a major upgrading of standards is expected over the next few years through new provincial and federal government initiatives.

The amount of municipal garbage presently generated in Canada approximates 4½ pounds per capita per day. This is likely to increase to 7½ pounds per day by 2000 if present trends continue. With the expected population increase, the total amount of garbage will almost triple in the next 30 to 35 years. Its composition is changing too: there is a rapidly increasing proportion of plastics.

Much disposal in Canada is by sanitary landfill, though not all operations can properly be described as "sanitary." Nevertheless, much progress has been made in recent years in cleaning up the old town dump. Many large centres use incineration as well as sanitary landfill. Some, like Edmonton and St. Catharines, pulverise the waste before disposing of it by sanitary landfill. Recent incinerator installations at

Montreal and Hamilton provide for steam generation, with the expectation that local industry will buy it. Another heat recovery installation is planned for Quebec City.

Attention is being focused increasingly on recovery and recycling. Mechanical separation of virtually any component from municipal waste is feasible, but not often economical. Local markets for recovered materials are difficult to develop. But where local circumstances are favourable, some products are being recovered. Newsprint and paper products are separated in many areas and returned for manufacture of paperboard containers. One plant in Ontario employs a de-inking process and manufactures quality bond from recycled material. Steel products, including derelict automobiles, are returned for reuse as raw material. Some areas have a market for recycled glass and aluminum. New approaches are required to counteract the "throw-away" products prevailing today. British Columbia and Alberta have passed legislation to control disposal of litter and beverage containers.

Another trend to improved management and cost reduction is evident in moves to regionalize operations rather than leave them to individual municipalities. Schemes of this type have been proposed at Lambton County, Hamilton, Wentworth and the Niagara region in Ontario. The provinces of British Columbia, Quebec and Ontario are reorganizing local government along regional lines to administer public services, including solid waste management. This is a trend to be encouraged, and the Canadian government is supporting an area-wide scheme for the National Capital Region, which will serve as a model for other communities.

5.4 The "Red" Herring Incident

Few pollution stories have received as much publicity as the "red" herring kills in Long Harbour, Placentia Bay, Newfoundland. In early February 1969, large numbers of herring, their heads and fins tinted brilliant red, were found dying on beaches near Long Harbour. "Red" herring were swimming near shore in a distressed condition. The "reds" were found as far away as St. Mary's Bay, 30 miles to the south. Local fishermen had to tie up their boats.

The new elemental phosphorus plant at Long Harbour was suspected as the source of trouble and was shut down.

A concerted scientific effort was carried out to determine the cause of the kills. Bio-assays on cod, sticklebacks and herring demonstrated that the effluent from the plant was toxic and produced haemolysis of red blood cells. Studies also showed that fish could not survive if mud from the floor of Long Harbour, near the plant outfall, were placed on the bottom of aquariums. Analysis of the mud showed the presence of elemental phosphorus, which was subsequently determined to be the cause of haemolysis and death in affected fish.

The contaminated mud in the harbour was subsequently removed by suction dredge from an area of approximately 160 acres. Fishing in the affected area was banned for a six-week period; the fishermen's loss of income was estimated at more than \$150,000. The loss was made up initially by the Government of Canada through loans, and later through direct payments to fishermen by the phosphorus plant. The plant returned to full production by late summer of 1969, after remedial action in the treatment of effluents and completion of dredging.

5.5 The "Arrow" Affair

On February 4, 1970, the 18,000 ton Liberian oil tanker "Arrow" carrying 16,000 tons of Bunker C fuel oil struck Cerebus Rock in Chedabucto Bay, Nova Scotia.

A task force set up to deal with the disaster identified three urgent problems:

- About 1,200 square miles of coastal waters, with 375 miles of coastline of which over half was contaminated, were affected. Thirty miles of tourist and community beaches required cleaning before summer.

- The livelihood of local fishermen.
- The ecological damage.

Many new scientific and technical problems had to be solved, as a major spill of Bunker C fuel oil under near arctic conditions had not been encountered before.

The ecological picture turned out to be less disastrous than expected. Divers found offshore bottom life was unaffected. The lobster season opened on schedule and the catch was normal. The herring catch was above normal, but fauna in the inter-tidal zone was affected. Twenty-five per cent of the clams died from suffocation; 2,300 birds are estimated to have died from oiling in Chedabucto Bay, while 4,800 died around Sable Island: some seals died from heavy oiling; but the overall lasting effects on fish and wildlife are not considered to have been significant.

The following are some highlights from the recommendations of the task force for preparedness and action in future emergencies.

International action

- A new international convention banning all deliberate dumping of oil, oily waste, tank cleaning or bilge cleaning into oceans or other navigable waters is needed.

- An international agreement for reporting spills in an orderly and understandable manner should be sought.

- Stricter controls on the adequacy and serviceability of navigation equipment on vessels are required.

National action

- Extensive pollution control zones should be established.

- Those who pollute should pay the cost of clean-up.

- All vessels entering Canadian waters should carry Canadian pilots unless ship and captain have special federal clearance.

- Standards of competence of crews on ships entering Canadian waters should conform with Canadian national standards.

- All bulk storage tanks holding petroleum products or other hazardous substances should be protected by effective dykes, and all pipelines along water courses should be similarly dyked.

5.6 Air pollution in the Detroit–Windsor Area

The Detroit–Windsor area exemplifies the difficulties of controlling air pollution in a multi-jurisdictional area. In this instance the prevailing meteorological conditions normally result in pollutants being transported from Detroit, Michigan, U.S.A., into Windsor, Ontario, Canada.

Under the leadership of the International Joint Commission substantial studies have been undertaken to define the sources of pollution and the scope of the problem. Preventive or remedial measures have been recommended. Agreement on ambient air quality objectives is of major importance in coming to grips with such trans-boundary problems.

Initially, the provincially defined objectives which applied to Windsor were more stringent than those which

applied to the State of Michigan and the City of Detroit. With the promulgation of United States National Air Quality Standards, the two sets of standards for similar pollutants became compatible. The difficulty has been overcome. Actual abatement and control functions, in line with common objectives, are now being undertaken by responsible control agencies in both countries.

5.7 Scrubbers vs Stacks

There are two air pollution abatement concepts: "concentrate and contain" – applied at the source by using the best practicable technology, such as scrubbers and precipitators; and "dilute and disperse" – effected through tall stacks. In normal practice, both are used in varying degrees. Bearing in mind the long-term aspects of industrial and urban growth and the concern with global aspects of pollution, the Canadian government favours the concept, "concentrate and contain".

Canadian scientists are divided on the benefits of tall stacks as an air pollution control measure. Proponents of tall stacks maintain that their effectiveness in dispersing sulphur dioxide in waste gases has been demonstrated in numerous installations. They claim that efficient dispersion will ensure the attainment of acceptable air quality at ground-level, in accordance with government standards. Opponents to tall stacks do not agree that sulphur dioxide emissions are rendered harmless by dispersion. Stacks, they state, will not remove pollutants from the air. Thus, chemical and physical transformation processes continue to produce secondary substances, such as sulphuric acid mist and neutral sulphate aerosols.

In this respect the benefits are of little consequence except in the area near the stack. Other problems have

also been noted. These include the washout of effluents to the ground by precipitation falling through the plumes that rise from the stacks; the influence of adverse meteorological conditions, frequency of "fumigations"; and the "real life" situation that occurs when production parameters are forced to change and a stack is operated under conditions other than those for which it was designed.

The concept of "concentrate and contain" is encouraged in Canada by an accelerated capital cost allowance program which allows a two-year capital cost write-off for pollution control equipment. Tall stacks do not qualify for such assistance. This has ruled out support for a 1,250 foot stack, being built by a Canadian plant as an air pollution control structure. In some cases, the technology for containment is not yet available and dispersion is then permitted, but only as a stop-gap measure to be replaced when a method of containment is developed.

5.8 Lung Cancer in Newfoundland Fluorspar Miners

Because of the incidence of lung disease among the fluorspar miners at St. Lawrence, Newfoundland, the Department of National Health and Welfare was requested, in 1956, to carry out a study of the dust hazards in the mines located in that area. The study was extended in 1958 to other environmental assessments and to epidemiological, clinical and experimental laboratory studies.

Initial findings showed that the dust concentrations were not alarming, although they were high in certain areas. By 1959, however, measurements of airborne radioactivity (radon and radon daughter products) showed concentrations well above suggested maximum permissible levels.

Coal-burning power generation stations serve many Canadian communities.

Des stations d'énergie électrique utilisant du charbon desservent plusieurs communautés canadiennes.



The first recorded case of lung cancer in this area was diagnosed in 1949. By the end of 1967, 53 deaths had been attributed to this disease. Of these, 51 occurred among 800 to 900 individuals who worked underground in these mines for more than one year. This incidence rate is many times that expected to occur in the general population in Canada.

Corrective measures (forced ventilation) implemented early in 1960 have effectively reduced the concentrations of airborne radioactivity to acceptable levels.

5.9 Environmental Arsenic at Yellowknife

The dispersal of arsenic into the environment at Yellowknife results from the roasting of gold ore containing arsenopyrite. An environmental study was started in 1950 by the Department of National Health and Welfare. In the period 1951–59, some 727 samples from the town water supply were analyzed. Approximately 15 per cent of the time the concentration was above the maximum permissible level of 0.05 ppm. The highest value observed was 2.9 ppm, compared with the "emergency" level of 0.3 ppm.

A detailed medical study made in 1966 included mortality, hospital admission and out-patient records; health survey of the whole community by questionnaire; a weekly house-to-house morbidity survey; and a clinical examination of a group of inhabitants who had exposure histories or suspected symptoms.

A high incidence of acute and chronic respiratory disease was found. It was concluded that arsenic in mill dust played a contributory role in the aetiology of these diseases. The prevalence of skin lesions was noted and was thought to be related to contact

with arsenic dust. Some significance was attached to the fact that abnormal electrocardiographic changes were found more frequently than expected.

A new water supply was installed by 1969. The mining company solved the disposal problem by installing massive underground concrete bunkers for permanent storage of the waste product.

5.10 Ecological Reserves for Posterity

Canada is a country of great ecological diversity. Such diversity enriches our lives by the wealth of recreational opportunities afforded, by the great variety of products from our lands and waters, and by the knowledge that studies of ecology reveal.

The activities of man have altered large areas of the primitive face of Canada and, inevitable and necessary as such activities were, we are the poorer for them. Canadians now recognize the necessity for establishing ecological reserves, and while significant progress has been made, we have much to do.

Ecological reserves are needed in remote areas and near our urban centres. They are needed to preserve unique or valuable ecosystems in an unaltered or relatively unaltered state for research on how ecosystems function, for the preservation of rare wild things (maintaining gene pools), and for preservation of characteristic plant and animal communities which future generations may find valuable. While national and provincial parks provide protection on a large scale to relatively few areas, many smaller ecological reserves are also needed. The very climatic and geographic parameters that encourage human settlement often apply equally to wildlife populations with the result that the greatest ecological diversity

may occur near our urban areas. Unfortunately, it is in these areas that the greatest environmental disruption and destruction occurs.

Some progress has been made. For example, a national program to acquire and protect important wetland habitat for migratory birds is being managed by the Canadian Wildlife Service. These national wildlife areas are established in co-operation with provincial governments. Additional wetland habitat is set aside and managed by joint federal-provincial agreement to protect habitats essential to migratory birds.

The Province of British Columbia enacted last year the Ecological Reserves Act and has already set aside a significant number of reserves. A centennial gift from the people of Canada to the people of British Columbia, in 1971, included establishment of a special fund for preservation of nature conservation areas in which the ecological communities can be protected and studied.

Caribou are an important source of food and clothing for some of Canada's northern Eskimo and Indian people.

Le caribou constitue une source importante d'aliments et de vêtements pour certains Esquimaux et certains Indiens du Nord.



6 Congestion and the Quality of Life

6.1 The Swing to the Cities

Despite Canada's huge land mass, three-quarters of its population live and work in cities and towns situated in less than one-hundredth of the nation's total land area. Of this urban population, a further two-thirds cluster in a dozen large cities and a half-dozen metropolitan areas.

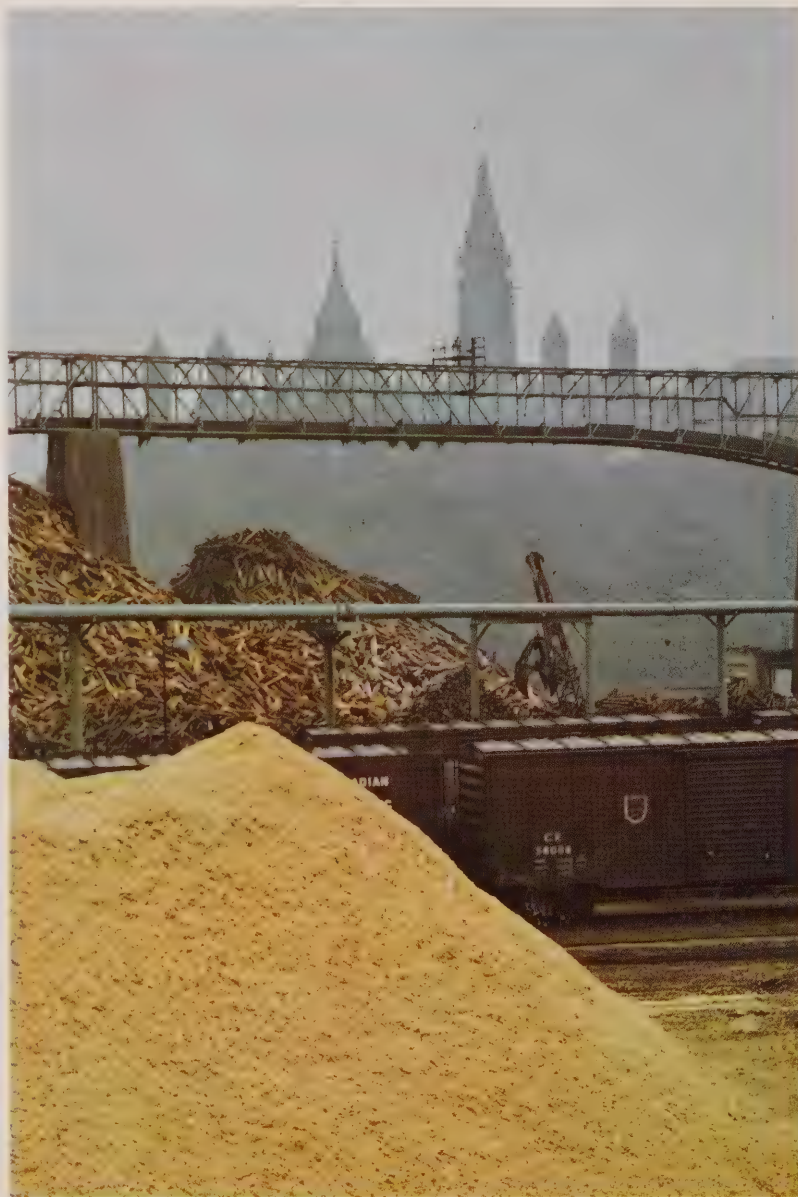
Urbanization has proceeded steadily for more than a century. Nor is there evidence that the technological, economic and social forces stimulating migration to the cities will abate. It is projected that by the year 2000, unless the trend can be slowed, Canada will be more than 90 per cent urban and three-quarters of the total population will live in fewer than twelve centres.

This concentration into a few megalopolises — stretching along the lower St. Lawrence, fringing the lower Great Lakes, overrunning the lower mainland of British Columbia — will continue. Montreal and Toronto, by the turn of the century, will probably be comparable in size to New York, Chicago and Los Angeles today. Vancouver will be bigger than Montreal today. Edmonton, Hamilton, Quebec City, Ottawa and Winnipeg will grow to about one million.

Canada has become urbanized more rapidly than any other industrialized country. Over the last two decades, the rate of urbanization has averaged more than 4 per cent per annum, far exceeding the second highest rate of 2.7 per cent in the United States. This trend cannot continue ad infinitum, but if we select a population of 500 thousand as a crude measure of maturity, Canada already has five "mature" urban centres and can expect seven more by the turn of the century. Any urban problems we have today will be intensified in the near future.

A pulp and paper mill across the Ottawa River from Canada's Parliament Buildings is being removed as part of the Federal Government's beautification program for the national capital region.

Une usine de pâtes et papiers sur la rivière Ottawa, près des édifices du Parlement sera démolie dans le cadre du programme fédéral d'embellissement de la région de la capitale nationale.



Cities are built to last. We must ensure that our descendants will be able to live well in them. The reduction of air, water and noise pollution, slums, sprawls and land speculation, and the provision of easier access to the great outdoors should be highlighted. Plans to improve the quality of life, especially in the downtown areas, are essential.

6.2 Pollution in Urban Communities

Community services are like the metabolic processes of a living organism. To sustain life, cities take in water, food and fuel. The wastes produced by their use are discharged into the air or water, or dumped on the land.

Given sufficient time natural processes of dispersal or purification can cope with limited volumes of domestic and industrial wastes. But with a growing population on the one hand, and a rising standard of living on the other, the intake of materials and the emission of waste products creates problems.

The day is long past when uncoordinated urbanization was good enough. What is dawning is an awareness that controls on urban development must include environmental considerations. Drastic measures may be called for. We need a greater degree of public control over the use and development of land within and between urban regions. We must certainly combat pollution, congestion, blight and sprawl. Measures must be developed and implemented to eliminate the unpleasant smells, sounds and sights which strike at those who live in cities.

In some Ontario cities air pollution alert systems interpret the results of a continuous monitoring of atmospheric quality and direct the cut-back of major industrial polluters.

The disposal of solid wastes in cities is a major problem. Secondary

Table 1.

Status of Waste Water Treatment in Major Urban Regions

Region	Population (000's)	Population Receiving Treatment	Population Served by Facilities (%)	Wastewater Flow (MGD)	Type of Sewage Treatment		Per cent of Wastewater Treated
					Primary	Secondary	
Toronto	1,800	1,800	100.0	194.0	—	100.0	100.0
Montreal	2,436	204	8.4	290.2	2.6	5.8	8.4
Vancouver	940	350	37.0	100.0	41.0	NIL	41.0
Ottawa	300	300	100.0	40.0	100.0	NIL	100.0
Edmonton	430	420	98.0	37.5	46.5	53.5	100.0
Hamilton	300	300	100.0	60.0	—	100.0	100.0
Quebec	300	NIL	NIL	42.0	NIL	NIL	0.0
Calgary	370	365	98.5	38.5	9.0	91.0	100.0
Winnipeg	520	520	96.0	44.5	—	100.0	100.0
Halifax	232	34	15.0	26.0	—	9.0	9.0
St. John's	85	NIL	NIL	11.0	NIL	NIL	0.0

Table 2

Annual Investment in "Sanitation" Projects in Canada

Year	Municipal Gross Expenditure on Sanitation (millions)
1956	—
1957	\$ 109
1958	104
1959	124
1960	133
1961	168
1962	167
1963	174
1964	175
1965	185
1966	206
1967	202
1968	225
1969*	234
1970*	267
1971*	328

*Estimated

Canadians have discovered the motorized snow vehicle as a form of winter recreation as well as transportation.

Les Canadiens ont découvert les véhicules motorisés pour se déplacer sur la neige autant par sport que par nécessité.

pollution problems often arise from disposal procedures. Incinerators must now conform with new standards for the control of air pollution. Some older installations have been redesigned, others eliminated.

Most communities have modern facilities for the supply and treatment of water for domestic and other uses. Over 80 per cent of municipalities with a population of 1,000 or over are adequately serviced. On the other hand, within the last decade only 40 per cent of municipal residents were served by sanitary sewers and only 60 per cent of urban sewage received any form of treatment (Table 1).

Only eight of Canada's 19 largest metropolitan areas treated 100 per cent of their sewage. Two — St. John's and Quebec City have no treatment whatsoever. Montreal, Canada's largest urban area provides some form of treatment for less than 10 per cent of its wastes.

But the picture is improving rapidly. The Province of Ontario treats almost 95 per cent of sewage from urban areas. Major programs are underway for the installation of advanced treatment processes for the removal of phosphate nutrients from sewage entering the lower Great Lakes and other key recreational waterways throughout Canada. Some regions, generally the less prosperous, have lagged. Accelerated programs are being given high priorities by all levels of governments to enable these to catch up.

The provinces offer a variety of assistance schemes, including total financing — construction, maintenance and operating costs — and subsequent sale back to the municipality over a 25 to 40 year period, and a wide range of loan and outright grant options. The largest loan and grant program is administered by the federal government

through the Central Mortgage and Housing Corporation. A loan equivalent to two-thirds of the capital cost of the project — trunk sewers and treatment plants — is provided. Of this, 25 per cent is forgivable. Over its 10 years of existence the program has distributed in excess of \$370 million, and its current expenditures are more than \$120 million annually.

To meet even the limited goal of "no further deterioration", Canada's total expenditures must increase. To catch up and improve, the annual requirements for sewage treatment plants

alone could reach \$350 to \$400 million by the year 2000.

There has been a rapid rise in municipal expenditures to meet existing sanitation commitments (Table 2). The cost is ultimately borne by the property owner. Canadians already pay the highest property taxes in the world, as a percentage of national income. This additional cost for sanitation will be hard to bear, particularly in those parts of the country where the average income is substantially below the national average.



The beaches of Prince Edward Island attract thousands of tourists from Canada and the United States.

Les plages de l'Île-du-Prince-Édouard attirent des milliers de touristes du Canada et des États-Unis.

6.3 Space for Recreation

Growing economic productivity has made possible a reduction in the working week and an increase in the mobility of the average Canadian. As his hours of leisure have risen, so has his demand for outdoor recreation.

About 10 per cent of the total urban area is available for such public recreational facilities as parks, golf courses, swimming pools and playgrounds. Present trends do not indicate any marked shift in land use, mainly because extensive open-air parks are likely to give way, increasingly, to space-saving capital-intensive facilities such as swimming pools, organized playgrounds, and stadia for spectator sports.

At the same time, the automobile and the expressway have increased the ability of the average urban resident in Canada "to get away from it all". In other words, the locus of outdoor recreational activity has shifted from within the city to surrounding areas, with important consequences for urban planning on a broad regional basis. "Greenbelts" and other open country are badly needed within reasonable distance of the city cores. Today, 20 per cent of the leisure time of Canadians is spent outside the cities and towns. By the year 2000, it might exceed 25 per cent. This increased activity outside cities will undoubtedly have a major effect on rural communities within easy driving distance of the large metropolitan areas.

It is expected that visitors to provincial and national parks will increase six-fold over the next three decades, with resulting increases in pressure on fish and wildlife. Use is also being made of some multi-purpose lands, in particular forest lands, where industry allows access for recreation purposes. Private lands are used extensively for camping

and vacation cottages. Ontario alone has 230,000 vacation cottages, which provide for a large part of the recreational needs of residents and non-residents.

The conflict between nature-lovers seeking the silence of the wilderness and those using such noise-making vehicles as aircraft, motorboats, dune buggies and snowmobiles, has become acute in some places. Aircraft and off-road land vehicles are directly affecting wildlife population. This is reflected in the fact that all but one of the 65 "endangered species" listed by the Cana-

dian Wildlife Service are threatened, not so much by over-hunting as by the deterioration of their natural habitat through the thoughtlessness of mankind.

More space for recreation is provided in some cities by sanitary landfill operations. A valuable commodity is thus created while dealing with a major waste disposal problem. For several years a Toronto suburb has been using a ski slope built of solid industrial wastes.



Trailer camping is an inexpensive and highly popular form of summer vacation in Canada.

Le camping constitue un loisir d'été très peu dispendieux et fort populaire au Canada.



Canada's lakes provide sailing enthusiasts with plenty of room for their sport.

Les lacs canadiens constituent un endroit de rêve pour les enthousiastes de la voile.



More conservation areas close to urban centres are needed to give the people places to relax and study the natural environment.

Un plus grand nombre de régions de conservation sont nécessaires près des centres urbains pour assurer à la population les endroits appropriés au repos et à l'étude de l'environnement naturel.



7 Strategies for Survival

7.1 People

Canada's population is still growing 1.5 per cent each year. Current projections indicate that it is unlikely to exceed 35 million by the year 2000. Viewed against the massive backdrop of the Canadian landscape, a nation of that size should be able to keep pollution under control. It should actually be able to improve its environment, relative to that of 1970, if it takes full advantage of new techniques for recycling waste products, installs more effective methods of treatment, and controls the distribution of harmful man-made substances.

Admittedly, growing population is a significant factor in increasing wastes. But increasing affluence has contributed to pollution more than bare population statistics would indicate. The impact of modern technology has been overwhelming. It has been more important than increasing population and rising per capita income combined. Since 1946, Canada's population has gone up 50 per cent; its per capita standard of living has gone up 66 per cent; but pollution, generally speaking, has gone up by more than 500 per cent.

Thus, environmental stress results from the interplay of population increase, per capita consumption of resources, and technological development.

The twin factors of population size and per capita resource consumption are fundamental to the achievement of balance between man and his environment. It is unrealistic to assume that our reserves of non-renewable resources are infinite. We are therefore faced with an eventual depletion of our supplies. However, much can be done in the short term to lessen the environmental impact while a sustainable balance is sought.

Co-operation between industry and government in developing environ-

mental plans and corrective measures can arrest, and effectively reverse, the trend to the gross environmental degradation which has been apparent over the last 25 years. But planners must also take into account that inhabitants of hitherto unexploited areas expect an improvement in their standard of living, which can come from development; and they must allow for the consequences of such activity when formulating plans.

Population growth is not yet a problem in Canada. But the feeling is growing, particularly among biologists, that the development of a population policy should be seriously considered by the people. There are indications that some government representatives are responding positively to this suggestion. Certainly, Canada will wish to be among those nations that seek a solution to what is really a global problem. Canada is a contributor to the Population Activity Fund at the United Nations.

7.2 Environmental Education

There is a need to improve environmental education at all levels. At the professional and technical levels, educational programs must provide the skilled manpower needed to tackle environmental problems quickly. There is a real shortage of skilled people now. In the elementary and high schools, improved programs will progressively develop the awareness and understanding of environmental problems which are needed if future problems are to be forestalled.

Fortunately, some important changes have recently been introduced to specialized and general environmental education in Canada. Interdisciplinary and pluridisciplinary programs in environmental, resource and planning studies have been established at a number of universities and colleges.

These studies are carried on in new faculties of environmental design and of environmental studies at universities, such as Calgary and York; and through co-ordinating committees at universities, such as British Columbia, Alberta and Western. Undergraduate degrees in environmental studies are also available at universities, such as Waterloo. Technical institutes or community colleges in provinces, such as Ontario and Alberta, offer training in recreation, environmental technology and other para-professional areas. All these programs supplement long-standing programs in urban studies at various universities and colleges in Canada.

Increasing interest in environmental education is developing in the schools, to supplement older programs in outdoor education. The need for rapid and significant progress in this area of general school education is recognized, but will require considerable integrated effort by federal, provincial and municipal authorities if the programs, facilities and general organizational arrangements are to be effective.

7.3 The Underlying Concern is for Human Health and Well-being

The health of Canadians is a critical factor that cannot be overlooked in the development of Canadian environmental policies. An all-embracing view of environment and health demands that the traditional public health fields where causes of disease and remedial measures are well known be considered as part of the total picture of environmental pollution, and given the necessary emphasis.

A greater awareness of cause-effect relationships has given rise to increased concern for the long-term consequences of environmental pollution to human health and well-being. For man, the important consideration

is his exposure to all sources. For example, the total intake by man of any one pollutant can be determined only by integrating the results of air, water and food monitoring with the results of properly designed nutritional surveys. This, in turn, can be interpreted only in relation to knowledge of metabolic and biological parameters and of effects from pollutants, either singly or in combination.

There is an urgent need for research to find more sensitive biological indicators which can serve as part of an early-warning system for environmental degradation.

7.4 Recycling is Essential

Priorities can be set for pollution abatement among the various industries. Those industries that use chemical processes are high on the list. They often operate on a large scale, but even relatively small quantities of some substances can damage the environment.

Regulations have been developed which will force some chlor-alkali industries to recycle part of their liquid effluents, sources of gross mercury pollution. Regulations have also been developed to control pulp and paper mill effluents, which account for a larger volume of waste than any other industry in the country. Some conventional wood-product processing operations in Canada will have to be drastically modified to comply with effluent requirements.

In the petroleum refining industry, the largest single use of water is for cooling. The discharge of oil and other contaminants per unit of oil processed increases with the quantity of water used. By recycling this water through cooling towers, the water usage can be reduced by as much as 90 per cent. This will result in a significant reduction of oil and oxygen-demanding sub-

stances leaving the refinery complex.

With the emphasis on recycling, and on keeping poisonous and oxygen-demanding substances inside the factory fence, Environment Canada has been working closely with other large growth industries, such as food processors (including breweries, distilleries and fish plants), petrochemical plants, iron and steel mills, and cement plants.

7.5 Product Protocols

So much for present technology. But what about the hundreds of new products which are being developed, marketed each year and littered or discharged throughout the countryside?

To the extent that these new products are artificial, to the extent that they are not biodegradable, to the extent that their disposal leads to concentrations that can be harmful to the environment, they must be vetted. They must be screened and found essentially harmless before they are sold widely to consumers and imposed on our biosphere in a routine way.

The long-term effects of man-made substances have yet to be determined. Some, like the PCB's, are already under observation. Drugs intended for direct human use already have to pass through a tight government screening process before they can be sold to the public at large.

A growing number of industrial products must undoubtedly be dealt with in the same way.

Environmental testing protocols are needed to protect man and all components of the environment. Such protocols will prescribe test procedures and evaluations aimed at both short- and long-term effects. They will contain clearly identified acceptability guidelines against which the results of the testing procedures can be compared. They will need to be up-dated regularly

to reflect the latest scientific and technological developments.

These protocols will provide a uniform approach, known and understood by both manufacturers and control agencies. They will represent the ground rules which the manufacturer will have to meet before he can market a new product. Because the procedures will be standardized, the results obtained by different agencies will be comparable. Mistakes, however, may still be made and corrective action will have to be taken.

There are already some examples of close collaboration in matters related to product testing in Canada. Environment Canada is working closely with Canada Health and Welfare to check out NTA – a substitute for phosphates in detergents.

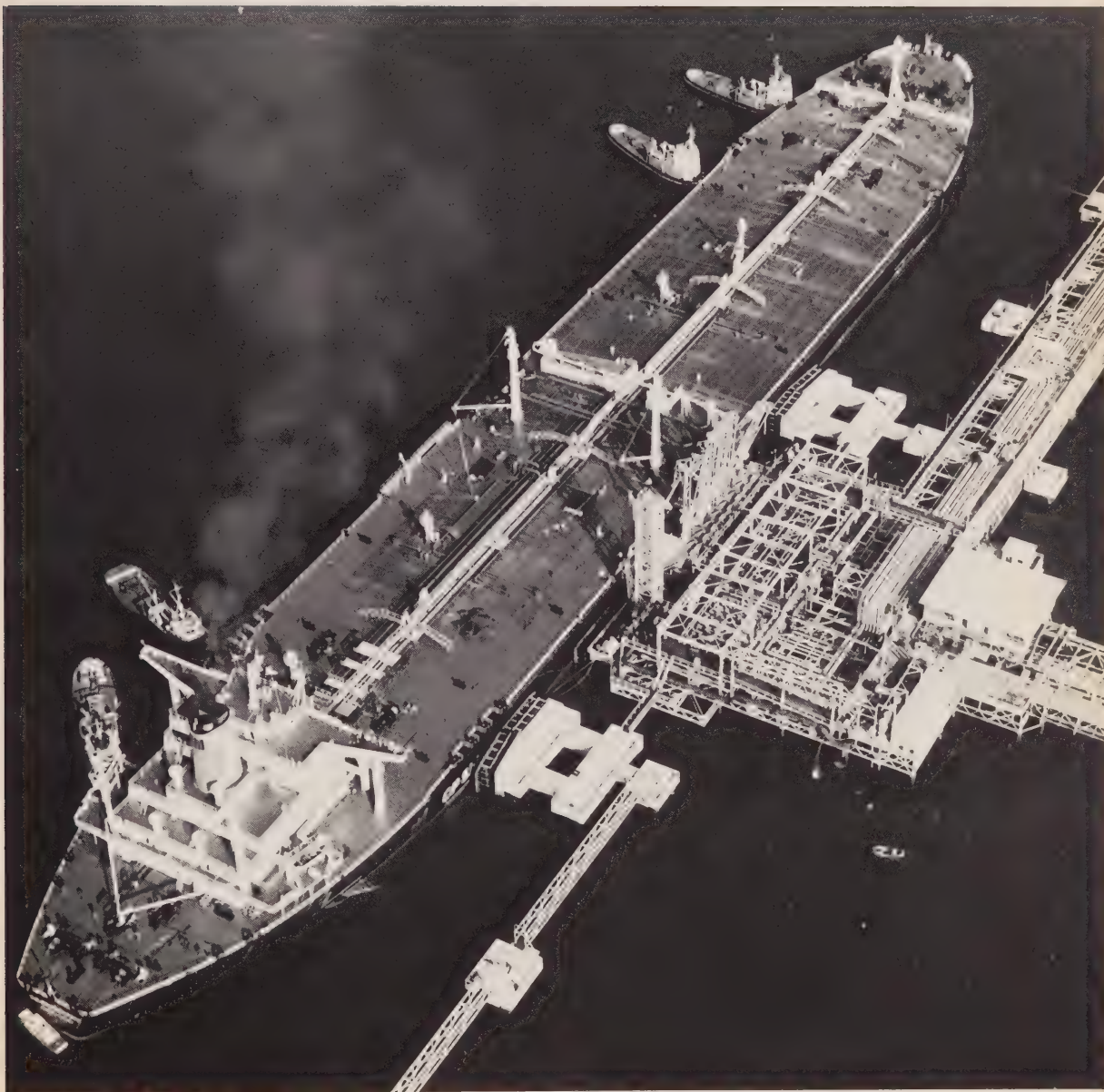
Here, as in the development of regulations covering recycling, government and industry must work hand in hand in a new partnership. In this way, industry can take part in developing reasonable regulations from the point of view of production. And government, employing engineers and scientists who have had experience in related industries, will be in a better position to make sure that the quantity of waste being discharged and the nature of the products offered for sale are not likely to have deleterious effects on our surroundings.

7.6 Planning for Environmental Emergencies

Oil spills from tankers and pipelines, chemical spills from railway cars, and accidental escape of toxic fumes from ruptured tanks will continue to occur. The production, transport and storage of many hazardous new substances will increase each year. Improved measures to prevent environmental emergencies will not eliminate

The world's largest tankers can be accommodated at the new super-port facility at Port Hawkesbury, Nova Scotia.

Les installations portuaires de Port Hawkesbury, en Nouvelle-Ecosse, permettent d'accueillir les plus grands navires-citernes au monde.



The Douglas fir of British Columbia is a major source of lumber.

Le pin Douglas en Colombie-Britannique constitue une source importante de bois d'oeuvre.

them completely, so contingency planning by governments and by industry will always be a necessity.

Environment Canada has been charged with the development of an Environmental Emergency Centre and the co-ordination of the federal government's response to requests for assistance with environmental accidents. The discharge of this responsibility will require the development of a national contingency plan that will integrate existing planning by many agencies. When completed the plan will ensure the most effective efforts within regions

of Canada to minimize damage from environmental accidents, and ensure national assistance to regions if required (see section 3.12).

7.7 Protect Endangered Species

Our goal for endangered species is to restore them to a secure position. The ultimate objectives are to prevent the loss of genetic material and to preserve species, in their wild forms if possible. Wild animals are good indicators of environmental degradation. If the environment cannot sustain wildlife, it may be unsuitable for man. That the

danger of extinction exists is an indication that we have somehow mismanaged our wildlife or modified their habitat. In wilderness areas endangered species can be protected in their natural state. In settled areas special measures are required.

At least 65 species of mammals, birds, amphibians, reptiles and fish are in danger in Canada. Rehabilitation measures to protect the species and their habitat include captive breeding programs, habitat preservation, public education and legislation. When rare and endangered species are affected the hazard of environmental pollution and habitat destruction must be viewed with the greatest urgency, and the necessary pollution abatement programs and land use and industrial planning must be implemented quickly. We need to study our wild living things as monitors of pollution so that remedial steps can be taken immediately.

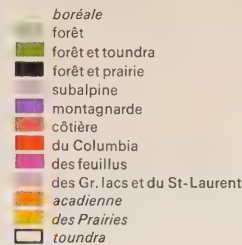
There is a useful body of federal and provincial legislation to protect plants, birds and animals; continuing co-operation at all levels of government is necessary for effective action.

7.8 Sustained Yield Operations

The forest, covering nearly 48 per cent of the nation's land surface, provides an important source of livelihood for about 10 per cent of Canada's population.

In much of Canada, forestry is the highest, and often the only, use to which the land can be put. Because trees can be harvested on a sustained yield basis, forestry can provide a stable income for people who wish to live outside the main industrial centres. Intensive management and shorter rotations will probably not be general over productive forest land but will be concentrated in areas of relatively good accessibility and growth.





The forest industry in Canada has been an enthusiastic supporter of land use studies. Like its counterparts elsewhere, it has taken an increasing interest in uses for forested land other than fibre production. It has a growing awareness of the value of fish and wildlife, and recreation is now actively encouraged by many firms which have opened up their logging roads to the general public.

Foresters explain that a forest is much akin to an organism. In youth, it is usually fast-growing and healthy. In middle age and early maturity, growth

slows down and little seems to happen for a long time. In late maturity, the infirmities of old age catch up with it. The toll exacted by insects, disease and wind more than counterbalances growth. The forest is ready for replacement and may become a focal point for the spread of insects and disease if allowed to linger.

The aim of management should be a mixture of different-aged stands so that the forest is never allowed to become overmature. The forest is then always growing. It is less prone to insects and disease than unmanaged

"wild" stands. It has variety, which lends itself to recreational use and abundant wildlife; and good accessibility which makes fire control easier.

It follows that opening up more of Canada's forest cover to commercial exploitation may be a good thing from an overall environmental point of view, not a bad thing. It will be financially advantageous and, assuming intelligent management, it should also be ecologically beneficial.

Forest Regions of Canada



Through international agreement Canada has established exclusive Canadian fishing zones on the west and east coasts.

À la suite d'accords internationaux, le Canada a établi des zones de pêche exclusives sur ses côtes occidentales et orientales.

7.9 Conservation of the Living Resources of the Sea

Of Canada's living natural resources, fish are the second most heavily used. If we include marine life out over the nation's continental shelf its relative importance is even greater. As the shelf itself is roughly equivalent to 40 per cent of Canada's land area, and includes some of the most productive banks known to commercial fishermen anywhere, the resource is obviously a very large one.

Large as these fish stocks are, they have not been sufficient, in recent years,

to withstand man's attack. Since the early 1960's too many commercial fishing vessels have been chasing too few fish. The northwest Atlantic fishery is overmanned today, as is the Pacific fishery. The result is inevitably either restrictions on catches or over-fishing.

In the north Pacific, through the International North Pacific Fisheries Commission and by separate negotiations, Canada and the United States have succeeded in retaining the valuable salmon deriving from stocks which spawn in North American rivers. This success has been based on the fact that

the available annual sustainable yield of these anadromous species is fully utilized on the North American side of the Pacific and the stocks are the subject of a comprehensive research and conservation management program. Canada has consistently maintained that such anadromous species should be considered the property of the country which maintains and improves the spawning grounds to produce the best possible yield.

The same principle should be applied on the Atlantic, where a high seas fishery for Atlantic salmon has developed



off west Greenland — to the detriment of stocks with home rivers in both North America and Europe. The delicate balance of this resource appears to be disrupted. Those who oppose a ban of high seas fishing insist that scientific information is insufficient to warrant such drastic action. In the meantime, as we await complete scientific proof, the resource is dwindling. Canada's recent production and harvest indicate that the Atlantic salmon is an endangered species, and its harvest on the high seas fishery must be phased out without delay.

Fortunately, Canada has made some progress in persuading other nations, whose commercial fishing vessels ply the north Atlantic, that the ill-effects of over-fishing must be countered soon. The member countries of the International Commission for the North-west Atlantic Fisheries (ICNAF) have recently asked for and received new powers. They have changed the convention under which they operate. They have, at long last, adopted the idea of sustained yield management, and have also begun to set national quotas for various species in selected areas of the North Atlantic off Canada.

Quotas were first put into effect in 1970 after over-fishing the last, good year-class of recruitment of the haddock stock on George's, Brown's, LeHave and Roseway Banks. Haddock stocks on these banks have reached a level where recovery can be expected to take many years.

ICNAF is considering quotas on cod and plaice stocks in the northwest Atlantic. Herring quotas will be applied in several areas off the Nova Scotia coasts in 1972. This will be the first species to be protected by international agreement on allotment of catch. Such a step should lead to more orderly operation of the fishery.

While various regional commissions have prompted certain conservation measures, a more effective and comprehensive approach to fisheries conservation and management is urgently needed. To this end, Canada has made detailed proposals on basic principles which should underlie fisheries conservation and management to the Preparatory Committee for the Law of the Sea Conference, proposed to be held in 1973.

7.10 Fisheries Agreements

The Government of Canada concluded agreements with Norway, in 1971, and with Britain, Denmark, France and Portugal, early in 1972, respecting their fishing practices off Canada's Atlantic coast. The agreements came into force at once and, with the exception of Spain, completed the negotiations initiated by Canada after the amendment of the Territorial Sea and Fishing Zones Act in 1970. These amendments established, in early 1971, the Gulf of St. Lawrence and other special bodies of water off Canada's east and west coasts as exclusive Canadian fishing zones. In the case of Britain, Denmark and Portugal the agreements provide for the termination of their traditional fishing practices over a period of time and for the avoidance of conflicts with Canadian inshore fishermen during those periods.

Expiry dates for the foreign fisheries vary, but mid 1978 is the latest for Canada's territorial sea and the end of 1976 for the Gulf of St. Lawrence. In the case of France, treaty rights were involved but these will be terminated for trawlers from metropolitan France in 1986. A reciprocal fishing arrangement has been made between Canadian and St. Pierre-Miquelon fishermen. A similar agreement was concluded with the United States in 1970.

In sum, the agreements provide not only for the termination of traditional fishing practices in our waters, but also for important recognition of the legislative steps the government has taken to establish a 12-mile territorial sea limit and exclusive fishing zones off our Atlantic coast.

7.11 Agriculture

Canadian agriculture occupies a large and important part of the Canadian environment. The farm community is the chief custodian and manager of extensive natural, mineral and biological resources, and owner and architect of much of the landscape. The agricultural biomass is a captor of solar energy, a regulator of the micro climate, and protector of a precious soil resource.

Canadian agriculture is a large and complex industry operating in all provinces under a wide range of climatic and soil conditions and producing a wide range of horticultural, field, meat and milk products. The industry is highly mechanized and technologically advanced. Productivity per producer is among the highest in the world, resulting in a productive capacity which far outruns domestic requirements. Consequently Canadian agricultural exports, mostly cereal grains and oilseeds, are a major part of Canadian trade. Because agriculture is so central a part to total Canadian activity, and particularly so in the prairies, international trade policies are of utmost importance. Canada has been an advocate and active participant in international commodity arrangements in the interests of sound development of agriculture and the rural community.

As noted earlier, governmental responsibilities for agriculture are divided among the provinces and the federal government. Within each level of administration a number of departments

The plains of southwestern Manitoba are intensively farmed and produce abundant mixed crops.

Les plaines du sud-ouest du Manitoba font l'objet d'une exploitation agricole intense et produisent des cultures mixtes abondantes.

have responsibilities which bear directly on the industry and the rural community. Co-ordination within and between administrations is difficult to maintain at all times, but is essential to ensure comparable circumstances on a national basis for Canadian farmers. Canadian agriculture nonetheless favours a national approach to land use planning. Although the provinces are responsible for production, they do adhere to national standards for the use of fertilizers, pesticides, and other chemicals in the production process. National standards and techniques are

being developed for managing effluents from livestock and poultry production units. In addition, national standards are used in grading raw and processed food products.

Canadian agriculture is a large employer although its labour component continues to decline. Various federal and provincial government programs, including federal regional economic expansion programs and the Canadian Small Farm Development Program, are directed to assisting in the retention of a viable farm community.

7.12 The Arctic Waters Pollution Prevention Act

In October 1966, the Prime Minister of Canada spoke of the water, ice and land areas of the Canadian Arctic Archipelago, as follows:

"We do not doubt for a moment that the rest of the world would find us at fault and hold us liable should we fail to ensure adequate protection of that environment from pollution or artificial deterioration. Canada would not permit this to happen. . . . It will not permit this to happen either in the name of freedom of the seas, or in the interests of economic development."

Prompted by increasing evidence of oceanic pollution by oil spills and the pioneer voyages of the tanker Manhattan in the North, the Canadian government passed the Arctic Waters Pollution Prevention Act. This Act asserts Canada's functional jurisdiction over the waters surrounding the Arctic Archipelago to a distance of 100 miles from shore.

Such action was necessary because of the inadequacies of current international law, customary and conventional, with respect to marine pollution in arctic waters. It was necessary also because unusual hazards exist north of the Arctic Circle. The effects of a large oil spill in this cold climate could take decades, even centuries, to dispel.

The problem of environmental preservation transcends traditional concepts of sovereignty and requires an imaginative new approach. The Arctic Waters Pollution Prevention Act makes clear the Canadian government's determination to discharge its responsibilities for the preservation of the arctic environment, but without denying access to world shipping, in the waters of the Canadian Arctic Archipelago and the Northwest Passage in particular.



The experimental oil tanker S.S. Manhattan attempts to navigate the Northwest Passage through the Arctic Archipelago. She is assisted by the Canadian Coast Guard icebreaker the John A. Macdonald.

Le pétrolier expérimental S.S. Manhattan tente de se frayer un chemin dans l'Archipel Arctique dans le Passage du Nord-ouest. Il est aidé d'un brise-glace de la Garde côtière canadienne, le John A. Macdonald.

7.13 Energy and the Environment

Canada has substantial sources of relatively clean energy.

Water-power, has been the major source of the nation's electricity requirements. Natural gas, the cleanest form of fossil energy, is available in large quantities in the western provinces, where it has long been used. It is now a widely used fuel for heating and processing in other parts of Canada. Oil fuels from domestic and foreign raw material are the principal source of energy in Canada, making this country the world's largest major oil consumer

on a per capita basis. Coal, much of it imported, is being increasingly used in electricity production.

Forecasts of Canadian energy requirements indicate impressive growth with increases concentrated on demands for clean fuels. Oil and gas will supply most of the increased demand over the next two or three decades. Fuel oils will contain low levels of sulphur, while motor fuels will have to meet the specifications for low-emission engines. A high proportion of electricity will be from thermal generation, with nuclear fuels progressively replacing fossil

fuels as an energy source.

Canada's nuclear power efforts have been concentrated on the development of reactors using natural uranium and heavy water. After completion of the fuel cycle, the fuel elements, called spent fuel, are permanently stored in water-filled concrete tanks at the power stations.

Using the natural uranium fueled, heavy water moderated reactors of the CANDU type, Canadian utilities producing electricity, but not undertaking fuel reprocessing, can eliminate problems associated with high level radio-



Canada is well advanced in the development of nuclear power, such as this installation at Douglas Point, Ontario.

Le Canada a beaucoup d'expérience dans le domaine de l'énergie nucléaire; cette installation nucléaire est située à Douglas Point, en Ontario.

active effluents. Radioactive waste discharges are kept to a minimum.

Canadian authorities dealing with nuclear energy do not expect any serious problems with radioactivity or the release of related substances, which would significantly affect the Canadian environment. Continual critical examination is being given to any possibilities of long-term radioactive damage, and to accident prevention and control.

The possibility of thermal pollution problems has been anticipated. Assessment and long range planning are underway to ensure that any hazards to eco-

systems are detected and controlled.

Other environmental aspects of the exploitation of our energy sources must be carefully considered. The proliferation of high voltage lines for transmitting energy and seismic lines used in prospecting can cause problems. Until recently more wood was destroyed in Alberta to clear the way for seismic lines than was cut for lumber or pulp.

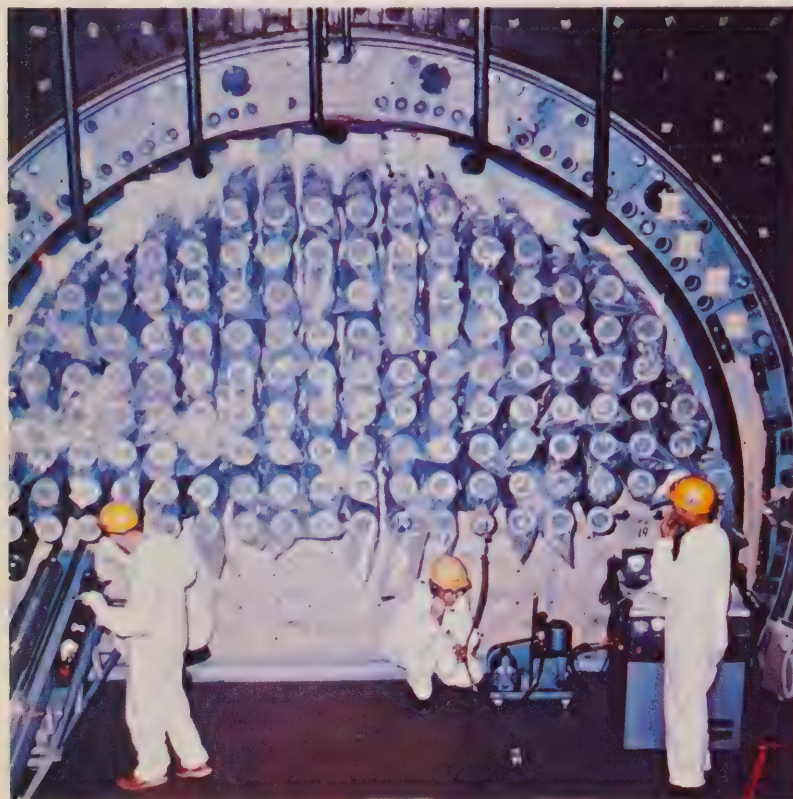
The movement of natural gas by pipeline from the Arctic to markets in the south across areas of permafrost is expected to prove practicable without serious ecological consequences. On

the other hand, the movement of "hot" oil from the North will inevitably call for greater care.

A government task force is engaged on a broadly based \$13 million study to select a route, or routes, which pipelines could follow across the Northwest Territories without upsetting the balance of nature. This will include gathering ecological information on the flora and fauna; developing a terrain sensitivity classification for areas which a pipeline might cross; locating areas of high sensitivity, which would require special stipulations or complete avoidance; formulating terms and conditions which would be of greatest benefit to the native people and result in minimal social disruption.

Offshore drilling has resulted in significant discoveries of oil and gas off Canada's east coast. Strict regulations, incorporated in a new Oil and Gas Production and Conservation Act, have been instituted to reduce to a minimum the likelihood of serious oil spills — from wells located offshore, or from collecting, storage and delivery facilities. Other regulations, and a national contingency plan, provide the resources, equipment and authority to ensure that, should there be an accidental spill of oil, the damage to the environment will be as little as possible.

Environment Canada will be designing sensitivity classifications to areas where drilling activity or petroleum production are likely to be too hazardous to the marine environment. By such zoning of bays, gulfs and seas, Canada ensures that fisheries are protected and coastlines retain their beauty, while essential resources are exploited.



The Keenleyside dam is one of several power development projects undertaken in British Columbia in recent years.

Le barrage Keenleyside est l'un des nombreux aménagements hydroélectriques réalisés en Colombie-Britannique au cours des dernières années.



Algae fed by nutrient-loaded wastes pollute streams and lakes.

Les algues alimentées par des déchets riches en agents de nutrition polluent des cours d'eau et des lacs.



8 Summing up

We have assessed the quality of our environment against the back-drop of geography and climate, and in the context of the distribution of our population and industry. We have identified some serious problems. Predictably, they tend to be concentrated in areas of high population.

A co-operative federal-provincial-industrial attack on environmental problems is emerging. Certain clear principles, such as "keep pollution within the factory fence" and "no havens for pollution" have evolved.

Federal and provincial legislation has been passed that requires new industry to operate cleanly, and provides old industry with a reasonable amount of time to catch up. We adopt the approach that the best available technology must be put to work to arrest pollution and then push it back.

The change in values that underlies the Canadian approach to environmental quality was reflected by Prime Minister Trudeau, speaking in Vancouver on May 1, 1971:

"At a time when we know without the slightest doubt that the ability of the biosphere to maintain life is finite, when we are aware that the resources available to us are limited, there are elements in our society which nevertheless assumes that man is at his ingenious best when his skills are employed to market products in ever more attractive, and often less disposable, packages. There is no shortage of persons who rationalize that for the benefits of shareholders or taxpayers, raw waste or sewage can be dumped with impunity into rivers or vented into the atmosphere.

"Surely we are not so ignorant as to assume that, somehow, the earth will begin producing more resources at an inexhaustible rate. Surely we do not prefer to live beside garbage dumps, to breathe smog, and to look out on pol-



luted oceans. Do we really believe that a high standard of living involves daily traffic jams and ear-splitting noise levels? Are we totally indifferent to the world in which our children and grandchildren will be forced to live? Have we, in short, permitted our common sense and our value system both to be so distorted that we equate "good" with "consumption" and "quality" with "growth"?

"Is it possible for Canadians to contribute to the solution of these vexing problems; to help in the evolution of a metaphysic and an ethic to write a new discourse on method, for the technological age? I believe it is.

"Technological accomplishment and population growth have both reached such a degree of acceleration that the world at this moment is placed precariously at the commencement of several exponential curves. Going up at a perilous rate are population and pollution; coming down at a rate of equal concern are reserves of natural resources and acreage suitable for cultivation. And we have been deluding ourselves for a quarter of a century with a misleading bookkeeping system that permits industry, and government, and agriculture, and every segment of the community, to pass on certain costs to society at large. Yet no businessman would calculate his net gain without first taking into effect the deterioration of his plant building, the depreciation of his machinery, and the depletion of his stock of raw materials. Why then do western governments continue to worship at the temple of Gross National Product? Isn't it time we paid heed to resource exhaustion, to environmental deterioration, to the social costs of overcrowding, to the extent of solid waste disposal? Shouldn't we, in short, be replacing our reliance on G.N.P. with a much more revealing figure — a



new statistic which might be called Net Human Benefit?"

Canada is but one member of the family of nations. The environmental problems which we seek to solve are not ours alone. Reflecting on Canada's position in the world environment it becomes apparent that it has a responsible role to play in seeking solutions to problems of national and international significance. Like other countries, Canada is vulnerable to environmental attack from the outside. Its shores, washed by three oceans, are vulnerable in the face of pollution entering oceans from the atmosphere, ships, land drainage and shore installations of other countries. In no other field is world co-operation more clearly needed.

The total effect of pollutants on the world atmosphere has yet to be determined. The drift of these pollutants across political boundaries and their ultimate effect on environments of other nations and of the oceans is of concern to Canada. The effect is nowhere more apparent than in this country. In summer months, with the prevailing south-westerly winds, a substantial part of air pollutants found in the atmosphere over Ontario, Quebec and the Atlantic provinces come from the United States.

Canada recognizes the need for international environmental monitoring systems and an international data bank on which sound decisions on necessary regulations may be based. Such a system should be designed to allow the governments of the world to anticipate problems, rather than react to them. The chain of life is delicate. Little is known about the effects of trace amounts of many chemicals entering our environment. How do they react singly or together? How long do they last? Not only monitoring of known dangerous substances but new co-operative research is needed on the

many thousands of unknowns.

As both a major exporter and importer of food and food products, Canada supports the development of a monitoring program on food contaminants. Man and wildlife are vulnerable to chemical pollutants in the food chain. Toxic chemicals enter the food chain in many ways and multiply up to 100,000 times as the larger feed on the contaminated smaller organisms and plants — and so up the chain to man.

It is apparent that the cost of ensuring environmental protection both at the national and international levels need not be unacceptably high. Technology is already available. More is on the way.

Another consideration enters the international picture — distribution of benefits. U Thant, former Secretary-General of the United Nations, speaking at the opening session of the Preparatory Committee for the United Nations Conference on the Human Environment, spoke for many Canadians when he said:

"...A new civilization characterized by more human beings, with longer lives and a better quality of life has flowered in the last two centuries, and is spreading slowly over the entire world. Justice in the world-wide distribution of these benefits has so far not been ensured. Indeed, it has been one of the major preoccupations of the world community during the last 25 years to enhance the share of the poorer countries in these benefits and to help in their development.

"The realization of a new and a very disturbing aspect of the spreading and growing of industrial civilization has now arisen: man has suddenly awakened to the dimensions, to the rapidity and to the mass effects of productive processes on the physical endowment and configuration of this planet and on

its basic biological balances. To produce at any cost, without due consideration to effects on the environment, can no longer be the central preoccupation of man. Control of the effects of productive processes will require a new economic thinking, new legal instruments, new administrative measures and new governmental priorities. I am convinced that men and institutions will be able to solve this problem in time, for under the pressures of necessity, man is quite capable of adapting to new conditions."

Appendix I

Canadian Environmental Legislation

Federal and provincial legislation having significant environmental implications is given below. The list is not complete, nor is it intended to be, however, the variety and depth of environmental concern in Canada is reflected in its contents.

Certain Acts embrace many facets of environmental control, whilst in other cases the legislation is divided between many Acts.

Federal Legislation

Aeronautics Act
Animal and Contagious Diseases Act
Arctic Waters Pollution Prevention Act
Atomic Energy Control Act
Boundary Waters Treaty (1909)
Canada Shipping Act (amended 1971)
Canada Water Act
(and Phosphate Regulations)
Canada Income Tax Act
Canadian National Railway Act
Clean Air Act
Criminal Code
Department of Transport Act
Destructive Insects and Pests Act
(Plant Quarantine Act)
Dominion Water Power Act
Fertilizers Act
Fisheries Act (amended 1970)
Fisheries Development Act
Food and Drug Act
Forestry Development and Research Act
Hazardous Products Act
International River Improvements Act
Migratory Birds Convention Act
Motor Vehicle Safety Act
National Energy Board Act
National Harbours Board Act
National Housing Act
National Parks Act
National Transportation Act
Navigable Waters Protection Act
Northern Canada Power Commission Act
Northern Inland Waters Act
Pest Control Products Act
Radiation Emitting Devices Act
Regional Development Incentives Act
St. Lawrence Seaway Authority Act
Territorial Sea and Fishing Zones Act
Transport Act

Provincial Legislation

Alberta

Agricultural Chemicals Act
Agricultural Pests Act
Agricultural Service Board Act
Beverage Container Act
Clean Air Act
Clean Water Act
Coal Mines Regulation Act
Department of Agricultural Act
Department of the Environment Act
Environmental Research Trust Act
Forests Act
Forests Reserves Act
Ground Water Control Act
Hydro and Electricity Energy Act
Irrigation Act
Litter Act
Mines and Minerals Act
Municipal Government Act
Municipal Assistance Act
Noxious Weeds Act
Oil and Gas Conservation Act
Pipelines Act
Planning Act
Provincial Parks Act
Public Lands Act
Quarries Regulation Act
Right of Entry Arbitration Act
Setting of Poison Act
Soil Conservation Act
Surface Land Conservation Act
Surface Reclamation Act
Water Resources Act
Wildlife Act
Willmore Wilderness Park Act

British Columbia

Coal Mines Regulation Act
Ecological Reserves Act
Environmental and Land Use Act
Fisheries Act
Forest Act
Health Act
Highway Act
Litter Act

Mines Regulation Act
 Motor Vehicle Act
 Municipal Treatment Plant
 Assistance Act
 Noxious Weeds Act
 Petroleum and Natural Gas Act
 Pharmacy Act
 Pipelines Act
 Pollution Control Act
 Taxation Act
 Water Act

Manitoba

Clean Environment Act
 Crown Lands Act
 Diking Authority Act
 Fires Prevention Act
 Fishermen's Assistance and
 Polluters Liability Act
 Fisheries Act
 Forest Act
 Ground Water and Water Well Act
 Industrial Minerals Drilling Act
 Mines Act
 Predator Control Act
 Public Health Act
 Rivers and Streams Act
 Water Commission Act
 Water Control and Conservation
 Branch Act
 Water Power Act
 Water Rights Act
 Water Supply Board Act
 Water Supply Districts Act
 Watershed Conservation Districts Act
 Wildlife Act

New Brunswick

Act Respecting Unsightly Premises
 Clean Environment Act
 Health Act
 Water Act

Newfoundland

Clean Air, Water and Soil Authority Act
 Crown Lands Act
 Department of Health (amended) Act
 Department of Municipal Affairs and
 Housing Act
 Local Governments Act
 Pesticides Control Act
 Waste Material (Disposal) Act
 Water Protection Act

Nova Scotia

*Act to Protect and Preserve the
 Environment
 Environmental Pollution Control Act
 Public Health Act
 Water Act

Ontario

Environmental Protection Act
 Ontario Water Resources Commission
 Act
 Pesticides Act
 Public Health Act
 Municipal Act
 Lakes and Rivers Improvement Act
 Planning Act
 Conservation Authorities Act

Prince Edward Island

Act to Control and Regulate the
 Distribution and the Use of Pesticides
 and Poisonous Top Killing Sprays
 Act to Control and Regulate the Use
 and Handling of Agricultural
 Chemicals
 Act to Establish the Prince Edward
 Island Environmental Control
 Commission
 Automobile Junk Yards Act
 Factories Act
 Fish and Game Protection Act
 Forestry Act
 Highway Advertisement Act
 Oil, Natural Gas and Minerals Act
 Plant Disease Eradication Act
 Power Commission Act

Public Health Act
 Recreation Development Act
 Roads Act
 Unsightly Premises Act
 Water and Sewerage Act

Quebec

The Quebec Water Board Act
 The Public Health Act
 Cities and Towns Act

Saskatchewan

Air Pollution Control Act
 Department of the Environment Act
 Ground Water Conservation Act
 Litter Control Act
 Oil and Gas Conservation Act
 Pollution (by livestock) Prevention
 Act
 Public Health Act
 Water Pollution Control Assistance Act
 Water Power Act
 Water Rights Act

Federal Territorial Ordinances

Northwest Territories

Pesticide Ordinance
 Petroleum Products Ordinance
 Public Health Ordinance
 Yellowknife Water Supply Ordinance

Yukon

Cemeteries and Burial Sites Ordinance
 Forest Protection Ordinance
 Game Ordinance
 Noise Prevention Ordinance
 Petroleum Products Ordinance
 Public Health Ordinance
 Saw Logs Driving Ordinance

*In draft form – pending

Appendix II

Canadian Preparatory Committee for the U.N. Conference on the Human Environment

The following list of individuals, institutions, departments and agencies represents the majority of comments contributed to this report. However, the final text was prepared by the Department of the Environment, Canadian Federal Government, and inclusion in this list does not necessarily imply concurrence with the text.

Chairman: Mr. E. G. Corbin, Parliamentary Secretary to the Honourable Jack Davis

Chairman: Federal-Provincial Committee, J. S. Mactavish, Environment Canada

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British Columbia
Mr. V. C. Raudsepp

Manitoba
Dr. P. Warner

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Mr. L. Chenard

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Mr. E. L. Rowe

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Dr. Gerald A. P. Carrothers
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Mr. William Hamilton
Canadian Federation of Agriculture
Mr. A. D. Hall
Canadian Forestry Association
Dr. N. E. Cooke
Canadian Manufacturers Association
Mr. James MacDonald
Canadian Labour Congress
Dr. Theodore Mosquin
Canadian Nature Federation
Mr. J. G. Gainer
Canadian Petroleum Association
Mr. R. C. Passmore
Canadian Wildlife Federation
M. Réjean Parent
Confederation of National
Trade Unions
Mr. C. Gordon O'Brien
Fisheries Council of Canada
Mr. Tagak Curley
Inuit Tapirisat
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International Youth Conference
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Mining Association of Canada
Mrs. Marie Marule
National Indian Brotherhood
Mr. Stewart Thiesson
National Farmers Unions

Dr. J. G. Nelson
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Professor E. G. Pleva
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of Canada
Mrs. Beatrice Bazar
United Nations Association in Canada
Dr. W. H. Cruickshank
Canadian Chamber of Commerce

Mr. Gilles Lamontagne
Canadian Federation of Mayors and
Municipalities

ICIEA Sub-Committee on the United Nations Environmental Activities

Departmental Representation

Environment Canada
External Affairs
Department of Agriculture
International Development Studies
of CIDA
Atomic Energy of Canada Limited
Atomic Energy Control Board
Central Mortgage and Housing
Corporation
Department of Consumer and
Corporate Affairs
Department of Indian Affairs and
Northern Development
Department of Industry, Trade and
Commerce
International Joint Commission
Department of Energy, Mines and
Resources
Department of Labour
Department of National Health and
Welfare
National Research Council
Department of Regional Economic
Expansion
Privy Council Office
Ministry of State for Science and
Technology
Ministry of Transport
Ministry of State for Urban Affairs

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Department of Indian Affairs and Northern Development:

Pages 13, 16, 49, 50, 54, 57, 58, 65.

Environment Canada: Pages 21, 45, 76.

Government of Alberta: Page 26.

Government of British Columbia: Pages 17 and 83.

Government of Manitoba: Page 80.

Government of New Brunswick: Page 47.

Government of Nova Scotia: Pages 43 and 75.

Government of Ontario: Pages 41 and 70.

Government of Saskatchewan: Page 51.

Imperial Oil Limited: Page 55.

Iron Ore Company of Canada: Page 25.

Ministry of Transport: Page 81.

Northwest Study Group: Page 55.

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Gouvernement de l'Alberta: page 26.

Gouvernement de la Colombie-Britannique:

pages 17, 83.

Gouvernement du Manitoba: page 80.

Gouvernement du Nouveau-Brunswick: page 47.

Gouvernement de la Nouvelle-Ecosse: pages 43, 75.

Gouvernement de l'Ontario: pages 41, 70.

Gouvernement de la Saskatchewan: page 51.

Groupe d'étude sur le Nord-ouest: page 55.

Imperial Oil Limited: page 55.

Iron Ore Company of Canada: page 25.

Ministère des Affaires indiennes et du Nord canadien:

pages 13, 16, 49, 50, 54, 57, 58, 65.

Ministère d'Etat aux Transports: page 81.

Office du tourisme du Gouvernement du Canada:

pages 12, 14, 15, 24, 69, 71.

Ontario Hydro: page 82.

Michel Proulx: pages 32, 85.



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